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THE CONDOR

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AN EXPERIMENTAL ANALYSIS OF THE BREEDING CYCLE OF THE TRICOLORED RED-WING

By JOHN T. EMLEN, JR.

It is generally agreed that the awakening or release of any particular behavior pattern is dependent upon two conditions: (1) an appropriate physiological state in the subject, and (2) a timely external stimulus. In birds, certain aspects of behavior, particularly those associated with breeding, pass through a cycle of striking changes as the season advances. These changes in behavior are paralleled by equally definite physiological and environmental changes, so that each stage in the behavior cycle has its characteristic internal and external concomitants.

The internal or physiological changes which occur during the year are reflected in the size, structure and activity of various organs of the body (see Riddle, 1938: 266-270), but are best defined for present purposes in terms of the behavior reactions which they underlie. Thus incubating behavior is the direct expression of a physiological condition variously referred to by writers as the incubation "drive," "impulse" or "urge." This drive, as with those that precede or follow it in the breeding cycle, is clear-cut and regular in its appearance and duration under normal circumstances. Although each of the specialized behavior patterns of the breeding season is closely related to the corresponding physiological condition, the two are not inseparable. Whitman (1919) and others have repeatedly demonstrated that a drive may exist unexpressed in the absence of an appropriate external stimulus.

The external stimuli with which we are here concerned are the specific situations in the physical environment which serve as the objectives of activity for each stage in the breeding cycle. A nest with eggs, for instance, is the specific situation toward which incubation behavior is directed. Nestlings are, in the same way, the direct objective of feeding-the-young behavior. Each of these situations is the product of activity of an earlier stage of the same breeding cycle. Thus a completed nest, which is associated with laying behavior, is created by the birds themselves during the preceding (nest-building) stage of the breeding cycle; a set of eggs, which is related to normal incubation behavior, is a direct product of egg-laying activity; and so on. Each external situation is thus seen to be dependent for its existence on the preceding stages of behavior, and each in turn functions to supply pertinent equipment to the cycle at the appropriate moment.

It is obvious that this succession of external situations is closely interrelated with the internal or physiological rhythm, and that for normal development the two must progress along parallel courses in harmonious synchrony. In the present study this synchrony was experimentally disrupted by modifying the normal progress of the external succession. By thus separating external stimuli from their normal internal concomitants, information was obtained on the degree of independence of the internal cycle, and on the significance of external situations as releasing agents.

The Tricolored Red-wing (*Agelaius tricolor*) was selected as the subject for study because of the ready availability of large numbers of nests within conveniently circumscribed limits (see Neff, 1937). Experiments were conducted in the spring of 1940 on 204 nests of this species in two colonies in the Sacramento Valley of California, one near

Hammonont with about 7000 nests and the other near Arboga with about 15,000 nests. Supplementary experiments were conducted on 26 nests of the Brewer Blackbird (*Euphagus cyanocephalus*) at Davis. Behavior responses were determined primarily through circumstantial evidence of activity; direct field observations, unfortunately, were limited.

Normal Behavior Cycle.—The temporal relations of stages in the breeding cycle of the Tricolored Red-wing are diagrammed in table 1. Mutual mating responses with coition usually appear at least 4 days before egg laying, and are continued until the commencement of incubation when nearly all the males leave the nesting environs (Lack and Emlen, 1939: 227). Nest building is performed entirely by the female and usually requires 2 to 5 days for the first nesting, and 4 (3 to 5) for the second. In a typical four-day nest-building period, the first day is spent in constructing the basal platform, the second in rounding up the sides, the third in forming the mud and wet vegetation, and the fourth in lining and completing the nest. The first egg is usually laid the day after building is finished. One egg is deposited each day for 3 or 4 days. Incubation behavior, confined to the female, usually starts with the laying of the last egg, or on the succeeding day, and continues for 11 (10 to 12) days before the eggs hatch; it then continues as a brooding response to nestlings, for at least 3 or 4 days more. Both sexes participate in feeding the young, the males reappearing at the appropriate time. Young are fed for 10 to 12 days in the nest and then for at least two weeks more in the nest vicinity.

TABLE 1

Schedule of behavior stages in the breeding cycle of male and female Tricolored Red-wings as related to changes in the external situation at the nest site. The beginning of a second cycle is indicated for the female.

Time in days	5		10		15		20		25		30		35	
Situation at nest site	A Responsive Mate Incomplete nest Unfilled nest		Nest with complete set of eggs		Nest with young		Nest with young		Nest with young		Young in nest vicinity		Young in nest vicinity	
Activities of male	Mating		(Absent)		Feeding of nestlings		Feeding of nestlings		Feeding of nestlings		Feeding of fledglings		Feeding of fledglings	
Activities of female	Mating Building Laying		Incubating		Brooding		Feeding of nestlings		Feeding of nestlings		Feeding of fledglings		Feeding of fledglings Building Laying	

Nests for second layings are started a day or two before the young of the first brood in that section of the colony leave their nests, and egg-laying begins about four days later. New nests for second layings are the rule, but old nests are occasionally built up and reoccupied. Birds were not individually marked, so it is not certain that second nests belonged to the same adults. Observations on behavior, however, support such an interpretation.

Mating.—No attempt was made in the present study to control or manipulate the elusive environmental factors associated with the release of the various phases of mating behavior, except as discussed later under "nest-building" and "egg-laying." A brief review of present knowledge of the subject, however, is in order.

The disposition to mate has been shown to develop under the influence of secretions of the pituitary, as when stimulated through increased exposure to light, until an advanced condition of gonadal development and of sexual responsiveness is attained

(Marshall, 1936: 435; Bissonnette, 1938: 246-254). The development of this condition into the final phase of mating behavior, however, seems to require the releasing action of an appropriate environmental situation in many birds. Thus a condition of sexual maturity, as judged by histological criteria, is inadequate to induce ovulation in female pigeons unless a male or some acceptable substitute is present to provide a stimulus through courtship, posturing and reciprocal mating behavior (Harper, 1904; Craig, 1911, 1913; Matthews, 1939) or through its mere presence (Patel, 1936: 145). This dependence on mates for the final stimulus to ovulation apparently is a fairly common phenomenon among birds (Marshall, 1936: 445; Bissonnette, 1939: 230). Other external factors, however, may also play a rôle in releasing the final stage of mating behavior. Certain captive parrots, for instance, will not pair or breed unless an artificial nest is provided in their cage (Manteifel, 1937). English robins may fail to breed if they are unsuccessful in establishing territorial claims (Lack, 1940: 264). Gulls that nest in colonies are influenced in their mating responses by the social stimulus of other members of the nesting flock (Goethe, 1937; Darling, 1938; Richter, 1939). Tricolored Red-wings probably also depend to a certain extent on mutual stimulation from colony associates, for the members of each nesting group show a marked simultaneity in breeding which is completely lacking as between different groups (Dawson, 1923: 113; Neff, 1937: 76; Lack and Emlen, 1939: 227).

Male birds are generally less dependent on environmental releasers for mating behavior than are females (Bissonnette, 1939: 230), but, at least in the pigeon, they may fail to exhibit the complete response until socially stimulated (Craig, 1914: 31).

Nest-building.—Nest-building behavior in female birds is usually closely related to mating, and in the Tricolored Red-wing, as in various other species (Howard, 1929, 1935); Tinbergen, 1939: 29), coincides with the short period of reciprocal mating behavior which immediately precedes egg-laying.

A relationship between this period in the behavior cycle and the final period of rapid ovular growth in the physiological cycle (Riddle, 1916) is suggested by various observations. Studies with pigeons, for instance, show that a sudden acceleration of physiological processes initiating the final period of ovular growth occurs $6\frac{1}{4}$ days before the first egg is laid (108 hours before ovulation, according to Riddle, 1938: 268, plus 42 hours before laying, according to Harper, 1904). The period of active reciprocal mating in these birds commences at almost exactly the same time, 6 to 7 days before laying (Whitman, 1919:3). Allen's (1914) data on the Red-winged Blackbird show a six-day period of rapid ovarian growth (plate 21) and a six-day period of nest building behavior (page 98). A similar coincidence of physiological activity and nest building behavior occurs in the Tricolored Red-wing (Emlen, unpublished data).

Experiments undertaken in the present study were designed to test the influence of nest stimuli on the duration of nest-building behavior and on the inception of laying which, under normal circumstances, marks its termination. Attempts were made to shorten the period by artificially accelerating the completion of nests. This was done by substituting advanced or finished nests at the site of newly begun structures. Prolongation of the period was essayed by robbing nearly completed nests of component materials. Similar experiments were performed on completed nests containing eggs or young to test the birds' inclination to return to nest-building behavior after laying had started.

Satisfactory results were obtained from 20 experiments. Nest desertion was frequent in the less advanced nests and accounted for 15 failures. Five experiments in which the lateral lining of nests was incompletely removed were unsatisfactory because of subse-

quent difficulty in differentiating new material from grasses trampled in from the nest margins.

The results of observations and experiments on nest building in the Tricolored Redwing (table 2) may be summarized as follows:

1. The period of nest-building activity normally covers the 4 (3 to 5) days before laying starts (13 control nests) and does not reappear thereafter (table 2, experiments 22 to 29, 32 to 40; see comments under "egg-laying" for interpretation of experiment 21).

2. Laying occasionally starts before the nest is completed. Under such circumstances construction may be extended for at least one day (table 2, experiments 17, 18; also see Dawson, 1923: 111).

3. Eggs or young artificially introduced into an incompleted nest will not necessarily interrupt the normal course of nest-building activity (table 2, experiments 13, 14, 15).

TABLE 2
Experiments with nest-building responses (second nestings)

No.	Stage of construction	Experiment	Result
1	Basal platform (1st day)	$\frac{3}{4}$ constructed nest substituted	abandoned
2		$\frac{1}{2}$ constructed nest substituted	abandoned
3		$\frac{1}{2}$ constructed nest substituted	abandoned
4		completed nest substituted	laid after 3-day rest
5	Sides rounded up (2d day)	completed nest + 2 eggs substituted	abandoned
6		completed nest + 2 yg. substituted	
7		$\frac{1}{2}$ the material removed	
8		$\frac{1}{2}$ the material removed	
9	Ready for lining (3d day)	$\frac{1}{2}$ the material removed	laid after 2-day rest
10		lining added	
11		lining + 1 yg. added	
12		lining + 2 yg. added	
13	Ready for lining (3d day)	1 egg added	abandoned
14		3 eggs added	lining completed, egg next day
15		2 young added	lining completed, egg next day
16		2 young added	abandoned
17	Ready for lining (1 egg)	lining partially completed next day
18		lining partially completed next day
19	Nest completed (4th day)	reduced to platform	abandoned
20	Nest completed (1 egg)		abandoned
21			lining replaced, laid 5 eggs
22			
23			
24	Nest completed (1 egg)		no new material added
25			
26			
27			
28	Nest completed (2 eggs)	lining removed	* abandoned
29			
30			
31			
32	Nest completed (2 eggs)		* abandoned
33			
34			
35			
36	Nest completed (3 eggs)		no new material added
37			
38			
39			
40	Nest completed (incub. advanced)		*

*Small amount of lining material present probably due to incomplete removal of lateral lining.

4. Four attempts to delay nest completion by artificial means were unsuccessful, but in two colonies where nest construction was interrupted or delayed by natural factors the birds commenced laying without regard to the incompleteness of their nests (Dawson, 1923: 111; Neff, 1937: 76).

5. Artificial completion of nests ahead of schedule did not hasten the commencement of laying but did relieve the owners of from one to three days of labor in nest construction (table 1, experiments 4, 11).

Egg-laying.—The duration of egg-laying behavior in the Tricolored Red-wing may be deduced from the size of the clutch, since the normal laying rate in all nests observed (one exception, see below) was one per day. Undisturbed nests in mid-incubation in the colonies under study contained 4 eggs in 87 instances, 3 eggs in 47 instances and 2 eggs in 7 instances, making an average of 3.6 eggs per nest. Some of the sets of 2 and 3 may have been reduced from a higher number through losses subsequent to laying, as attested in the records of a number of experimental nests. No natural sets of 5 eggs were seen, although nests with 5, 6 and even 7 have been recorded for the species by Dawson (1923: 110).

The factors which govern the cessation of laying in birds are poorly understood. Certain species of gallinaceous birds, ducks, woodpeckers and passerines lay until an accumulation of eggs releases the incubation response (Groebels, 1937: 243; Marshall, 1936: 443; Pearl, 1912: 158). These birds have been termed "indeterminate layers" by Cole (1917: 504) in accordance with their ability to continue laying indefinitely if their eggs are removed from the nest as laid. In other species, including certain pheasants, doves, pigeons and passerines, the size of the clutch, and hence the duration of the laying period, is apparently predetermined by intra-organic factors when egg-laying is begun (Craig, 1913: 219). This group Cole terms "determinate layers."

Experiments to determine the effects of egg accumulation on the duration of laying in the Tricolored Red-wing were of two types: (1) attempts to prolong the period by removing eggs, and (2) attempts to shorten it by artificially filling out incompleting sets.

Definite results were obtained from 62 of the 119 experiments undertaken. Of the 57 nests that failed to produce reliable information, 19 were abandoned before results could be read; 16, according to subsequent observations, had been partially incubated at the time of manipulation; and 22 were disturbed by natural causes.

The results of these experiments show that the Tricolored Red-wing is a determinate layer, that is, the egg-laying period cannot be prolonged by the process of removing eggs from the nest during laying. This was borne out in 10 of the 12 completed nest-robbing experiments (table 3, experiments 48-62). Both exceptions represent atypical conditions. One (no. 62) was probably complicated by the laying of two females, since three eggs, one of them larger than the others, appeared in the nest in 2 days. The other (no. 51) was peculiar in being the only instance in which a resumption of nest building was induced (by removal of the lining) after an egg had been laid in a completed nest (see table 2, no. 21). It seems likely that the second irregularity of behavior in this instance was related to the first. If the clutch in determinate layers is released as a pre-determined unit, as suggested by Craig (1913: 219), it is possible that the egg-laying period in this instance was recommenced or advanced a day after an initial start had been "called back" by further, artificially induced, nest-building activity.

Premature completion of the clutch with artificially introduced eggs failed to influence the length of the laying period in 34 out of 42 satisfactory experiments (table 3, nos. 1-47). In the remaining eight experiments (table 3, nos. 1, 2, 11, 16, 20, 22, 34, 40), however, a subnormal number of eggs (2) was laid, and in 6 of these the accumulated total was only 3 or 4. The average number of eggs laid in all supplemented nests

TABLE 3
Experiments with adding or removing eggs during the laying period

Experiment No.	Experiment			Results		Deductions
	a	b	c			
	Number of eggs at start of experiment	Eggs removed (-) or added (+)	Eggs in nest after manipulation (a+b)	Eggs in nest after incubation had started	Number of eggs laid	Laying affected by manipulation
1	0	+1	1	3	2	Yes
2	0	+1	1	3	2	Yes
3	0	+1	1	5	4	No
4	0	+1	1	5	4	No
5	0	+1	1	4	3	?
6	0	+1	1	4	3	?
7	0	+2	2	6	4	No
8	0	+2	2	5	3	No
9	1	+1	2	5	4	No
10	1	+1	2	4	3	?
11	1	+2	3	4	2	Yes
12	1	+2	3	5	3	No
13	1	+2	3	6	4	No
14	1	+2	3	5	3	No
15	1	+2	3	6	4	No
16	1	+2	3	4	2	Yes
17	1	+2	3	5	3	No
18	1	+2	3	6	4	No
19	1	+2	3	5	3	No
20	1	+3	4	5	2	Yes
21	1	+3	4	6	3	No
22	1	+3	4	5	2	Yes
23	1	+3	4	6	3	No
24	1	+3	4	6	3	No
25	1	+3	4	6	3	No
26	1	+3	4	6	3	No
27	1	+3	4	6	3	No
28	1	+3	4	6	3	No
29	1	+3	4	6	3	No
30	2	+1	3	5	4	No
31	2	+1	3	5	4	No

Experiment No.	Experiment			Results		Deductions
	a	b	c			
	Number of eggs at start of experiment	Eggs removed (-) or added (+)	Eggs in nest after manipulation (a+b)	Eggs in nest after incubation had started	Number of eggs laid	Laying affected by manipulation
32	2	+1	3	4	3	?
33	2	+1	3	5	4	No
34	2	+2	4	4	2	Yes
35	2	+2	4	5	3	No
36	2	+2	4	6	4	No
37	2	+2	4	5	3	No
38	2	+2	4	6	4	No
39	2	+2	4	5	3	No
40	2	+2	4	4	2	Yes
41	2	+2	4	6	4	No
42	2	+2	4	5	3	No
43	2	+2	4	6	4	No
44	2	+2	4	5	3	No
45	2	+3	5	7	4	No
46	3	+1	4	5	4	No
47	3	+1	4	4	3	?
48	4	-2	2	2	4	No
49	3	-2	1	2	4	No
50	3	-2	1	2	4	No
51	3	-2	1	3	5	Yes
52	3	-2	1	2	4	No
53	3	-2	1	2	4	No
54	3	-2	1	1	3	No
55	3	-2	1	2	4	No
56	3	-2	0	1	4	No
57	2	-1	1	3	4	?
58	2	-1	1	2	3	No
59	2	-1	1	2	3	No
60	2	-1	1	3	4	?
61	2	-1	1	3	4	?
62	2	-1	1	4	5	Yes

was 3.3 as compared with 3.6 in undisturbed nests, and where as many as 3 eggs were introduced, the birds laid an average of only 2.8. There was, thus, a tendency toward smaller clutches in some of the supplemented nests, particularly those treated early in laying. This may represent either a slight response by the bird to eggs in the nest, or an increased loss of eggs through accidents attendant on an overcrowded nest. The latter possibility must not be overlooked, for when more than 5 eggs are present, they generally become arranged in two tiers, bringing the upper eggs perilously close to the nest rim.

Observations and experiments on egg-laying may be summarized as follows:

1. The duration of the egg-laying period is generally 3 or 4 days; one egg is laid each day.
2. The laying period was not prolonged by artificial removal of eggs from the nest during laying and was shortened only slightly if at all by addition of eggs to the nest during laying.

3. The rate and duration of egg-laying was not affected by: (a) removal of nest lining (13 instances, no exceptions); (b) the hatching of previously introduced eggs in the nest (1 instance, no exceptions); (c) the presence of artificially introduced nestlings being fed by the male (4 instances, no exceptions, 2 questionable records).

Incubation.—The transition from the laying stage to the incubation stage forms an important turning point in the breeding cycle of birds. Riddle (1938: 267) remarks: "One may hope to witness few more striking changes in an animal than those involved in the passage of a pigeon from the copulatory to the broody phase; yet the time interval between the two phases may be no more than 48 hours." Whitman (1919: 104) concluded from his studies that "incubation and sexual activity are mutually exclusive and antagonistic phenomena" and that they "never occur together" in the pigeon. Mating behavior has been observed during the incubation period in a few wild birds (Kirkman, 1937: 197; Schüz, 1932: 20; Witherby, et al., 1938: 14), but it is definitely a rare phenomenon. Riddle and Bates (1930: 695) believe that prolactin, the hormone of the incubation period, acts to suppress the endocrine activity of the gonad in pigeons, and suggest that some such gonad inhibiting factor must be present during incubation in all birds "which nest their eggs."

Sexual activity, although it is generally submerged as soon as incubation sets in, apparently performs an important function in conditioning the bird for incubation behavior; for incubation rarely appears except as a sequel to mating behavior. The male of a pair has been known to display incubation behavior before its mate has laid (Howard, 1935:6; Watson, 1908:223), but the absence of eggs is no criterion of sexual unpreparedness in a male bird. Whitman (1919: 103) observed no instances in his pigeons where a bird manifested a broody impulse without previous sexual activity, and he believed that incubation behavior was "a physiological outgrowth of these former acts." Patel (1936:145) found that removal of the gonads in male pigeons did not alter the incubation behavior which followed in the same cycle but apparently precluded subsequent expression of normal incubation behavior. In experiments with prolactin injections, Riddle (1937: 223) observed that sexually conditioned (laying) chickens responded more readily than did non-laying birds.

A nest containing eggs or egg substitutes (Friedmann, 1934: 33; Kirkman, 1937: 89) is generally necessary for the release of incubating behavior in birds. Exceptions, however, are not uncommon; domestic poultry and pigeons occasionally react in a broody manner to inanimate objects or even to a bare floor. Howard (1935) cites several instances in which nests of wild birds continued to elicit the broody response after their contents had been removed, and Patel (1936:134) has demonstrated that the mere sight of a brooding mate through a partition may be adequate to arouse and maintain incubation behavior in pigeons.

The stimulus to incubate produced by the sight of a nest with eggs may be very strong. Taibell (1928) induced broodiness in a turkey cock merely by tying it to a nest with eggs. Watson (1908:223), by introducing an egg into an empty nest, induced the incubating response in a male tern a week before its mate had laid.

The influence of the presence of eggs on the duration and continuity of the incubation period is profound. Terns have been caused to extend their incubating response as much as 7 days and to shorten it by a similar amount (Lashley, 1915: 82). Domestic hens have been known to sit on dummy eggs for as long as 4 months (Hillwald, cited in Katz, 1937: 150). Leverkühn (1891: 30) induced a Marsh Harrier to incubate continuously for 8½ weeks. A Black-headed Gull sat on a wooden egg for 75 days (Kirkman, 1940). Pigeons and doves will sit for an average of 4 to 6 days beyond the normal

hatching date despite restrictions imposed by maturing of the "crop glands" (Cole and Kirkpatrick, 1915: 502-506). Game keepers in Europe recognize and make use of the flexibility of the incubation stage when they practice the "Euston system" of substituting well incubated eggs for freshly laid clutches (Maxwell, 1911: 109) in order to reduce the sitting period and hence the incidence of egg destruction.

Several workers have demonstrated that incubation behavior may be recalled after a brief interruption. Lashley (1915: 80) found that by returning eggs to robbed nests he could revive the incubating instinct in terns 4 days after it had been interrupted; he states that in many cage birds this period of suspension may be extended to more than a week. Patel (1936:139) found that in pigeons the development of the "crop glands," which is closely related to broody behavior, could be checked and started again several times by alternating the presence and absence of nest stimuli.

The brooding of nestlings should perhaps be included under incubation since it bears a closer resemblance and probably a closer relationship to sitting on eggs than to feeding of nestlings. Howard (1935: 32, 42) presents evidence for this relationship in his experiments with European Linnets and Yellow Buntings in which the nestlings, placed in an adjacent nest drew the feeding reactions of the parents while the empty old nest continued as the objective of sitting behavior.

In the Tricolored Red-wing, incubation behavior occurs only in the female. It normally extends through an 11-day period until the eggs hatch and then continues in gradually diminishing intensity for at least 3 or 4 days more as a brooding response to nestlings. Males are generally absent from the colony until the eggs hatch and they assist only in feeding operations thereafter.

In 23 experiments on Tricolored Red-wing nests, eggs far advanced in incubation were introduced into nests containing fresh eggs. In all of these the new eggs were accepted and the young which hatched a day or so later deflected the entire attention of the "parents" away from their own eggs. Thus, the period devoted to incubation of eggs was reduced from the normal 11 (10 to 12) days to 6 (2 instances), 5 (2 instances), 3 (1 instance), 2 (4 instances), 1 (4 instances), and 0 (7 instances) days; three experiments were inconclusive. Eggs laid by the nest owner in these 23 nests failed to hatch because of the premature cessation of incubation, but in 4 other nests where the introduced eggs were only 2, 2, 2 and 4 days, respectively, ahead of the owner's, eggs from both groups hatched.

Nestlings 2 to 3 days of age were introduced into 10 nests where the laying phase was just being completed. In 2 of these the old birds deserted, in the other 8 the strange nestlings took precedence over the eggs, and the nest owners passed directly from laying into the feeding-the-young stage.

Two incomplete attempts were made to extend the period of incubation behavior beyond the normal. In one nest the substitution of fresh eggs for a partially incubated clutch delayed hatching by 3 days. In the other a sterile egg was accepted in place of the single day-old nestling and incubated for 2 days. Eggs substituted for 2-day old nestlings in a Brewer Blackbird nest at Davis were accepted and incubated for 2 days before they hatched.

Observations and experiments dealing with the incubation period may be summarized as follows:

1. Incubation (sitting) behavior in the Tricolored Red-wing occurs only in the female. The normal duration is 11 days on eggs, plus 3 or more on nestlings.
2. The period of incubation behavior may be greatly reduced and even eliminated from the cycle by manipulating the nest contents.

3. The period of incubation behavior may be extended at least 3 days. No checks were made on the limits of extension.

Feeding the young.—Feeding-the-young behavior is regulated in pigeons by the appearance of "milk" in the crop which is, in turn, closely timed in relation to previous developments of the physiological cycle from mating onward (Patel, 1936:143). As a consequence any considerable advance or delay in the appearance of the young is highly disruptive (Whitman, 1919:68). In most birds, however, no such restrictive internal mechanism is in control; indeed the urge to feed young seems to be more or less independent of the rest of the breeding cycle. Non-breeding birds will, on occasion, respond to the begging-for-food stimulus, and fledglings of the first brood may assist in the feeding of the second (Skutch, 1936; Ruthke, 1939). Even pigeons may exhibit a partial response outside of the breeding cycle; Whitman (1919:68) has recorded two instances in which squabs of 11 and 12 days went through the motions of food delivery in response to the food-begging actions of nest mates.

The stimulus for feeding-the-young behavior is normally the presence of nestlings calling for food in the nest, or of fledged young similarly calling in the nest vicinity. The identity of the nestlings in the nest is apparently of minor importance in the Tricolored Red-wing, for no difficulties were encountered in transferring young from nest to nest up to the end of nestling life.

The normal feeding period of the Tricolored Red-wing may be divided into two phases: (1) feeding of nestlings in the nest and (2) feeding of fledged young in the nest vicinity. The first phase usually requires about 11 days, although nestlings may leave the nest when alarmed as early as the 9th day. A few experiments on the time limits of this phase of the cycle showed it to be very flexible. Advanced ($9 \pm$ days) nestlings were successfully established in place of 3-day-old young in one nest and of 2-day-old young in another. This served to reduce the feeding-of-nestlings stage from 11 to 5 and 4 days, respectively. Two-day young were introduced into one nest when the rightful young were 10 days old and the attending pair was thus induced to feed nestlings for 17 consecutive days. Feeding behavior in one nest was discontinued with the removal of the 2-day-old introduced nestling, then resumed 7 days later when the rightful eggs hatched.

Experiments described in this paper under *incubation* show that the feeding response to nestlings may be aroused in Tricolored Red-wings at any time in the laying or incubation stages of the cycle. In two nests watched from a blind the male fed the introduced nestlings during the laying stage, ceasing all singing and mating behavior while so employed. The female brought very little if any food to the nest until she had finished laying. Apparently neither sex responds to young in the nest during the nest-building stage. Young were introduced into partially built nests in 6 experiments. In 4 of these the owners deserted. In the other two (table 2, experiments 11, 15), the strange nestlings were merely disregarded and became lost or partially buried in the lining as construction proceeded. These observations suggest that sexual activity inhibits the feeding response to nestlings. It should be noted, however, that birds building for the second cycle were simultaneously feeding recently fledged young of the first brood. Tinbergen (1939:45) has noted a similar incompatibility between sexual activity and the response to nestlings in Snow Buntings, and is of the opinion that males of that species may not be able to feed young and pair with a female at the same time. In the domestic chicken, although males do not normally respond to chicks, they may do so following castration.

Observations on feeding-the-young behavior in Tricolored Red-wings may be summarized as follows:

1. Young are fed by adults of both sexes for 11 days in the nest, then for roughly two weeks in the nest vicinity.

2. Feeding responses are aroused by the presence of any nestlings in the "home" nest, and subsequently by fledged young in the nest vicinity. Adults respond to strange nestlings as readily as to their own.

3. The feeding-the-nestlings stage was experimentally reduced to 4 days and extended to 17 days by manipulating nest contents.

4. Feeding-of-nestlings behavior may be discontinued and subsequently resumed during the same breeding cycle.

5. Males respond to young in their own nest at any time after laying has started; females, at any time after incubation has started.

Conclusions.—The development of breeding behavior in the Tricolored Red-wing is closely regulated by physiological factors from the start of nest-building through the initiation of incubation. During the rest of the cycle, however, the rate of development is largely controlled by external situations associated with the nest.

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BIRDS OF THE ST. JOE NATIONAL FOREST, IDAHO

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In presenting the following record of my observations in one of northern Idaho's national forests, a few points should be made clear to the reader. In the first place, the author is under no illusion that the list approaches completeness for the area under consideration. Because of a preponderance of sight records, care has been taken to eliminate the questionable and unconfirmed. A few unusual species are included where the evidence seems conclusive, but many more have been "weeded out." No attempt has been made to assemble all previous records from this locality, but so far as the author is aware, Shaw's references to the Hepburn Rosy Finch in the Moscow Mountains (Auk, 53, 1936:9-16; 133-149) and a few of his own notes in past issues of the Auk and the Condor constitute the only published records. Merrill's "Birds of Fort Sherman" (Auk, 14, 1897:347-357; 15, 1898:14-22) and Rust's "Birds of Kootenai County, Idaho" (Condor, 17, 1915:118-129) refer to the "St. Joseph" or St. Joe Marshes, but the inference is that this means the extensive marsh area near the mouth of the St. Joe River and thus outside the scope of this paper.

Scope.—The St. Joe National Forest area under consideration embraces roughly one and one-half million acres lying in parts of Shoshone, Benewah, Latah, and Clearwater counties. The practical administrative, rather than the strictly legal, boundary has been used to restrict the range of this study for quite obvious reasons. The western half of the Forest appears as a checkerboard pattern of intermingled federal, state, and private land, as yet unclosed by a technical boundary. Government acquisition has already added greatly to the original acreage so that eventual adjustments will almost certainly come about. In other words, the limits used for practical purposes are reasonably stable and well defined while the present legal boundary is not.

The town of St. Maries and the adjacent marshes, while lying partly outside the forest protective zone, are included because from a biological standpoint they are a natural part of the unit. Actually, any bird seen within this area is almost certain to occur at times in the National Forest, or at least to pass over some part of it.

The St. Joe National Forest as thus prescribed extends practically across the "pan-handle" of the state from the prairies of the Palouse, eastward to the Montana line and from the North Fork of the Clearwater River northward to the St. Joe-Coeur d'Alene Divide (see map, fig. 61).

Climate and topography.—In general, the eastern half or "Main Division" of the Forest is rough, broken and characterized by short, cool summers and heavy winter snowfall. Altitudes range from 2400 feet on the main river to about 7000 feet on the higher mountain tops. The bulk of this area is in the Canadian Life-zone with both the Transition and Hudsonian zones well represented, the former restricted to the larger valleys and adjacent lower southern exposures, the latter to the higher peaks and ridge-tops. Except for "clean burns" and typical Alpine meadows, the entire area is heavily forested. Cedar and white pine predominate at the lower levels, white pine, Douglas fir and western larch at moderate altitudes, and spruce, lodgepole pine and subalpine types in the higher country. Approximately two-thirds of the area was burned over during the terrible fires of 1910 or subsequent thereto, but there still remains a large, continuous body of mature timber extending in a broad belt from Monumental Buttes in a northeasterly direction to the state line.

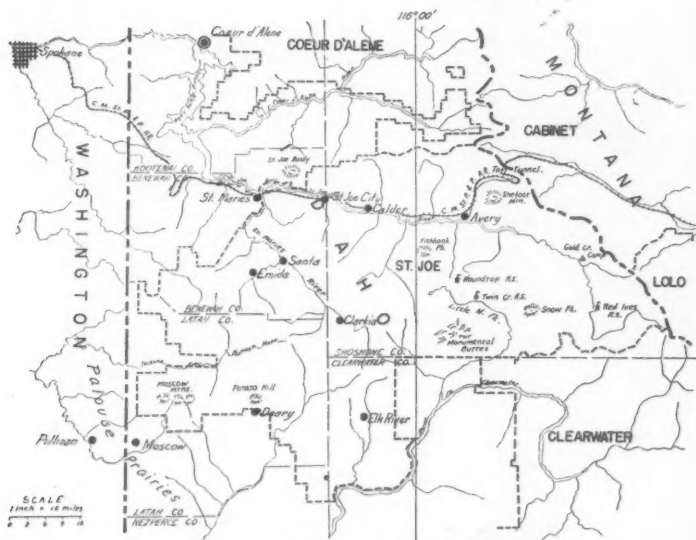


Fig. 61. Map of the St. Joe National Forest, northern Idaho.

Westward from the one hundred and sixteenth meridian, which very nearly bisects the forest, the topography gradually becomes less rugged, while the main canyon widens, imperceptibly at first, then more rapidly until it becomes the bottom-land, hay-meadow and marsh area of the lower St. Joe Valley. Altitudes here vary from 2100 feet at the town of St. Maries, which is the National Forest Headquarters, to somewhat above 5000 feet at the northern boundary and to at least 6000 feet at the eastern border where it joins the Main Division. The climate in general is somewhat milder and the snowfall correspondingly less, while the Transition Zone widens and the Hudsonian disappears, or at least shrinks, to a few isolated mountain-tops in the eastern part and possibly at the top of St. Joe Baldy. Only along the St. Joe, St. Maries, and Palouse rivers is there any open agricultural land of consequence, but on the mild south and west exposures the Transition Zone extends upward to include wide areas of open western yellow pine, a type almost wanting in the eastern half of the forest. To complete the picture one must visualize even here the Canadian Zone forests of cut-over white pine occupying the damp north and east exposures in a broken but nearly continuous belt westward almost to the edge of the prairies. This zone, however, is modified somewhat by the climatic effect of large denuded areas produced by the unrestricted logging of twenty years ago.

Perhaps one of the most interesting localities within an area in which rugged mountains and rushing torrents predominate is the lake and marsh belt in the vicinity of St. Maries. Here the annual change in water level brings about a diversity of conditions which provides habitats for numerous species not found elsewhere. Wide expanses of flooded bottom lands which attract numerous waterfowl in spring, become potholes surrounded by extensive mud flats that provide feeding grounds for several species of shore birds in fall. Willow and cottonwood swamps, cattail marshes and woodland-bordered lakes may all be found within this comparatively restricted area.



Fig. 62. Twin Creek Ranger Station, St. Joe National Forest; mountain meadow in the Canadian Zone.

Period of observation.—The author's observations in the St. Joe country began in the early summer of 1921 and continued, more or less interruptedly, to the present year. The summers of 1921 and 1922 were spent entirely in the mountains of the upper St. Joe and Little North Fork of the Clearwater, with the preceding and intervening winters at Moscow, which is only a few miles from the extreme southwestern boundary of the present St. Joe Forest protective zone. Then came an absence of seven years during which I was stationed in the Lochsa country some fifty miles to the south, followed by an equal period of almost constant occupancy and travel within the confines of the St. Joe Forest. During this latter period which extended from the spring of 1930 to the early summer of 1937, the writer crossed and recrossed the entire forest by car, horseback, and foot travel; included were several midwinter trips on snowshoes. While most of such travel was on government business not connected especially with the study of wildlife, the keeping of nature notes has been almost a lifelong habit, and these notes are the basis upon which the present list is founded. Observations in the past several years so far as the St. Joe Forest is concerned have been confined to occasional trips, as might be expected with a travel itinerary that now covers the entire northern Rocky Mountain region.

In defense of a list based largely on sight identification, the author wishes to emphasize the fact that his concern is not so much with the presentation of a complete record as in opening up channels for future study. While recognizing fully the value of scientific collecting, he makes no apology for the fact that he seldom carries a gun and that barring a few hawks, owls, and game birds, he has never shot a specimen in his life. Moreover, he believes that there is room for both the shotgun and field-glass student, and that the one is as likely to overstep the limits of scientific approval as the other.

In the following list, the approach to the question of subspecies is that which appears most logical under the circumstances. All the kinds of birds are discussed under their specific names, both scientific and vernacular. In those instances where some special comment is made concerning a race, it is included within the text under the account of the whole species. Thus, I have avoided making assumptions as to the identity of subspecies, which to be dependable need to be based on study of skins that are preserved in some museum. The field is rich in possibilities for a determined collector who could

no doubt solve many questions of subspecific identity as well as add greatly to the length of the list.

Gavia immer. Common Loon. Occasional spring migrant on floodwaters near St. Maries. Single birds noted between March 20 and April 30. To be looked for on alpine lakes in the mountains during fall migration, as I have noted them quite frequently at such times on lakes of the Clearwater Forest to the southward.

Colymbus nigricollis. Eared Grebe. Uncommon spring migrant in marshes near St. Maries. May. One individual in breeding plumage seen, July 11, 1936. Noted once in September on Steamboat Lake near Monumental Buttes. They are common fall migrants on lakes of the Clearwater Forest.

Podilymbus podiceps. Pied-billed Grebe. Common summer resident near St. Maries. April to November. Breeds. Noted rarely in mild winters.

Ardea herodias. Great Blue Heron. Noted commonly as a late summer and fall visitor in the marshes near St. Maries. July to October. Probably nests along lakes to the westward. Occasional in winter.

Botaurus lentiginosus. American Bittern. Common summer resident in the marshes of the lower St. Joe and St. Maries rivers. Mid-April to late September. Undoubtedly breeds.

Cygnus columbianus. Whistling Swan. Regular spring migrant at St. Maries. Late March to late April. Usually in flocks of from 15 to 75 individuals. Reported from Chatcolet and Coeur d' Alene lakes in open winters.

Branta canadensis. Canada Goose. Formerly a common migrant at St. Maries but becoming scarce in recent years. March and November. Flocks occasionally seen flying over the high mountains in fall.

Anas platyrhynchos. Mallard. Common resident. Breeds in the marshes near St. Maries and probably elsewhere. Winters in small numbers on unfrozen waters and during mild winters in much larger numbers. Widely distributed at all ponds, sloughs and potholes in migrations.

Mareca americana. Baldpate. Usually a common migrant but varies greatly in abundance from year to year. Late March to May; October and November. Occasionally seen on the extreme upper St. Joe.

Dafila acuta. Pintail. Fairly common and regular spring migrant in the vicinity of St. Maries. March to May. Seldom noted in large flocks but usually well distributed.

Nettion carolinense. Green-winged Teal. A fairly common migrant. April to May; September to November. Usually in small flocks but quite widely distributed. Mated pairs seen near St. Maries on several occasions in early June indicate possibility of breeding there. Should be looked for on mountain lakes in the fall as I have noted them frequently in this environment in the Clearwater Forest.

Querquedula discors. Blue-winged Teal. Noted only in the marshes near St. Maries where it appears regularly in spring, though in small numbers. Late April or early May to June. Generally noted in mated pairs; may breed. Probably occurs in fall but difficult to distinguish at that time from the much more common Cinnamon Teal.

Querquedula cyanoptera. Cinnamon Teal. Common summer resident, breeding in the marshes near St. Maries. April to October.

Spatula clypeata. Shoveller. Irregular but usually common spring migrant in the marshes of the lower St. Joe and St. Maries rivers. April and May.

Aix sponsa. Wood Duck. Common summer resident along the woodland-bordered portions of the St. Joe from St. Joe City down to the lakes. April to October. Breeds. Frequents the marshes in fair-sized flocks in late summer and fall.

Nyroca americana. Redhead. Irregular spring migrant on the lower St. Joe. Early April to mid-May. Sometimes abundant for a short period; at other times rare. Noted once in late September near St. Maries.

Nyroca collaris. Ring-necked Duck. Irregular migrant in the vicinity of St. Maries. April to early May; November and early December. Never appears in large numbers but sometimes quite common and widely distributed.

Nyroca valisineria. Canvas-back. Usually an uncommon spring migrant at St. Maries but occasionally appears in fair numbers for a few days. April and early May.

Nyroca affinis. Lesser Scaup Duck. Common migrant on floodwaters of the lower St. Joe, remaining as long as there is open water. March to April; November and December. Occasional during mild winters.

Glaucionetta clangula. Golden-eye. A fairly common and regular migrant during floodwater stage of the lower St. Joe. Remains all winter so long as there is open water. December through April.

Charitonetta albeola. Buffle-head. A rather uncommon spring migrant at St. Maries. April and early May. Has become scarcer in recent years.

Histrionicus histrionicus. Harlequin Duck. Rare summer resident on the upper St. Joe and probably also on the Little North Fork of the Clearwater. I have noted this species only in May, but Forest Ranger C. H. Scribner of St. Maries has a good photograph which he took of a brooding female on its nest at the mouth of Malin Creek between Avery and Red Ives Ranger Station.

Erismatura jamaicensis. Ruddy Duck. Rare. Noted occasionally near St. Maries in May. For some reason Ruddies appear to be very scarce here though they are fairly common in similar situations in both eastern Washington and western Montana.

Lophodytes cucullatus. Hooded Merganser. Rather common migrant and occasional summer resident near St. Maries. Probably breeds. Late March to November.



Fig. 63. Monumental Buttes, showing country typical of the higher elevations in the Main Division of the St. Joe Forest.

Mergus merganser. American Merganser. Common summer resident, breeding along the St. Joe from St. Joe City to Red Ives Ranger Station and perhaps above. Probably breeds also on the Little North Fork of the Clearwater where I have seen it in late summer and fall. Frequent at St. Maries in open winters.

Cathartes aura. Turkey Vulture. An uncommon straggler in summer. One seen July 15, 1931, on the Little North Fork slope, east of Monumental Buttes, and a flock of nine noted July 9, 1935, on St. Maries Peak, just east of St. Maries.

Astur atricapillus. Goshawk. Probably resident in the mountains of the Main Division. A young male collected July 27, 1930, was believed to be of the western form (Condor, 35, 1933:36), although the validity of this race seems to be in doubt. Seen most frequently from late August to November.

Accipiter velox. Sharp-shinned Hawk. Resident. Undoubtedly breeds in the mountains. Common during migrations and occasional in winter.

Accipiter cooperii. Cooper Hawk. Summer resident; probably breeds. Usually less common than the Sharp-shin, but occasionally appears in large numbers in fall. April to October.

Buteo borealis. Red-tailed Hawk. Fairly common summer resident, especially in extensive burned areas in the mountains. March to late October.

Buteo swainsoni. Swainson Hawk. Noted only as a rare straggler in August on high, open ridgetops. Should be looked for in the Moscow Mountain area, as I have seen them occasionally in the Palouse country.

Buteo lagopus. Rough-legged Hawk. Occasional migrant and winter visitor in the low valleys of the western part. October to late March.

Aquila chrysaetos. Golden Eagle. While I have noted them on both adjoining national forests (Coeur d'Alene and Clearwater) I have never actually seen a living specimen on the St. Joe. A mounted specimen seen at Moscow in 1935 was reported to have been shot near Elk River. Forest Ranger E. W. Renshaw, formerly of Avery, told me that a pair of eagles nested in the cliffs near the top of Shefoot Mountain in the late nineteen twenties. His description as well as the character of the site would indicate this species.

Haliaeetus leucocephalus. Bald Eagle. Rare. Probably resident. A pair nested along the Little

North Fork of the Clearwater in 1930 and 1931 and individuals were seen in the same vicinity and on the upper St. Joe on infrequent occasions in summer and fall. An adult seen at Chatcolet Lake, February 24, 1939.

Circus hudsonius. Marsh Hawk. Summer resident in the Palouse country but noted within the National Forest only in fall migration. Immature birds sometimes are common on high, open ridge tops in the mountains during August and early September. I have seen occasional individuals in the vicinity of St. Maries and on the upper Palouse from late March to May and in September and October.

Pandion haliaetus. Osprey. Summer resident. April to September. Breeds along the larger streams of the Main Division. Noted regularly at St. Maries in spring. Not rare, but persecuted too much by fishermen ever to become common.

Falco mexicanus. Prairie Falcon. Rare; perhaps only accidental. A medium-sized falcon, presumably of this species, was seen near Snow Peak on the Main Division, June 16, 1930. On July 27, 1940, I saw one from the train window near Taft Tunnel, just over the state line on the Idaho side. It flew parallel to and close to the car I was in, so that under the excellent light conditions that prevailed, identity was practically certain.

Falco columbarius. Pigeon Hawk. Rare. Noted on the Main Division on a few occasions in August and once, October 3, 1936, near St. Maries.

Falco sparverius. Sparrow Hawk. Common summer resident. April to October. The commonest raptor in this locality, being found in open and burned areas throughout the mountains as well as in the low, agricultural valleys.

Dendragapus obscurus. Dusky Grouse. Common resident in the high mountains, occasionally wandering to low altitudes in fall. While the drain from hunters' kills, added to natural predation, keeps their numbers down, I have on a few occasions noted unusual concentrations of these birds. In August, 1934, no less than one hundred and fifty were seen feeding at one time on a bare mountain slope on the St. Joe-Clearwater divide. As evening approached, they took wing by individual coveys composed largely of young birds and flew down over the hill to their roosting grounds.

Canachites franklinii. Franklin Grouse. Resident. Usually quite common, locally, but fluctuating in numbers from year to year. Noted almost exclusively in the green-timbered belt of the Main Division at altitudes ranging from 4000 to 6000 feet.

Bonasa umbellus. Ruffed Grouse. Common resident. Noted at low to moderate altitudes in timbered and brushy country of both divisions.

Pedioecetes phasianellus. Sharp-tailed Grouse. Probably extinct in this locality, but formerly common north and east of Moscow. A covey of five seen October 27, 1920, near the southern base of Moscow Mountain.

Perdix perdix. European Partridge. Resident; introduced. Found in moderate numbers in the vicinity of St. Maries and along the upper Palouse.

Colinus virginianus. Bob-white. Rare resident; introduced. While common in the near-by prairie country it is almost unknown in the St. Joe region except possibly on the upper Palouse River. One heard calling on the outskirts of St. Maries, July 1, 1934.

Lophortyx californica. California Quail. I have never noted this species in the St. Joe country, although it has been introduced into many areas in northern Idaho and is common in some localities. Individuals have been reliably reported from the vicinity of Clarkia and I have seen the clearly recognizable photograph of one taken by Mr. W. E. Kickbush, a former ranger who acted as caretaker at the Gold Creek CCC Camp during the winter of 1934-35. Apparently a lone individual, it remained about this camp on the upper St. Joe and was fed by the caretaker throughout most of the winter.

Phasianus colchicus. Ring-necked Pheasant. Introduced and now quite common in the open, agricultural portion of the lower St. Joe, St. Maries, and Palouse valleys.

Rallus limicola. Virginia Rail. Evidently a summer resident; probably breeds in the marsh area surrounding the old abandoned sawmill at East St. Maries. Noted commonly between April 25 and June 6.

Porzana carolina. Sora. Fairly common summer resident; probably breeds in the marshes near St. Maries. April to September.

Fulica americana. American Coot. A very abundant migrant and common summer resident, breeding in the marshes near St. Maries. April to November. Individuals occasionally winter.

Oxyechus vociferus. Killdeer. Common summer resident; breeds in the open, agricultural areas. March to October. Occasional individuals noted in fall migration in the mountains. Winters rarely near St. Maries.

Squatarola squatarola. Black-bellied Plover. Rare fall migrant. From one to three individuals noted on numerous occasions in the mud flats near St. Maries between September 19 and October 4, 1936.

Capella delicata. Wilson Snipe. Common summer resident; undoubtedly breeds in the marsh areas of the St. Maries and lower St. Joe rivers. April to October. Individuals seen rarely in the mountains in fall migration.

Actitis macularia. Spotted Sandpiper. Common summer resident, breeding along the larger streams throughout the Forest. May to September.

Tringa solitaria. Solitary Sandpiper. Uncommon migrant, but noted both in the mountains and the lower valley. May; August to September.

Totanus melanoleucus. Greater Yellow-legs. I have never seen this species in the St. Joe region although I have noted it both to the north and south. There is one definite record, however. Victor Jones of Pocatello, Idaho, collected one from a flock of 25 on the Wonderlich Ranch at St. Maries, August 4, 1938.

Totanus flavipes. Lesser Yellow-legs. Rare. Single individuals noted on several occasions between April 19 and May 11, 1935, in the marsh just east of St. Maries.

Pisobia melanotos. Pectoral Sandpiper. Noted fairly commonly along the marsh borders and mud flats near St. Maries from September 17 to 30, 1934, and a single individual seen in the same locality September 26, 1936.

Limnodromus griseus. Dowitcher. Flocks of six to fifteen individuals noted frequently between September 7 and October 10, 1936, on the mud flats near St. Maries.

Phalaropus fulicarius. Red Phalarope. One seen at East St. Maries, October 13 and 14, 1934. While a sight record, I feel impelled to include this because of the exceptional nature of the observation. Observed at leisure with binoculars at extremely short range (Auk, 52, 1935:180-181).

Steganopus tricolor. Wilson Phalarope. Rather uncommon. Noted only in the marshes east of St. Maries, in May. Single individuals and groups of up to five or six.

Stercorarius parasiticus. Parasitic Jaeger. One seen near St. Maries, September 23, 1936. This is another case of a sight record under conditions making it almost impossible to mistake the identity. While I could not get within close range because of the treacherous mud flats, the bird was watched for at least a half hour through a 20X Wollensack telescope. For a time it stood in shallow water apparently feeding on the small fish that become concentrated as the water recedes with the drying up of the potholes. It was in the light color phase and its tern-like build and black cap were noticeable. When it took wing (as it frequently did), length of the central tail feathers and the general size of the bird pointed to this species rather than the Long-tailed.

Larus delawarensis. Ring-billed Gull. Rather common migrant, especially in fall; occasionally appears in winters when there is sufficient open water. Noted only in the vicinity of St. Maries. March to May; September to December.

Chlidonias nigra. Black Tern. Common summer resident; breeds in the marshes of the lower St. Joe. Arrives about May 10 and departs in mid-August. I have seen flocks of at least a hundred birds near St. Maries in May.

Zenaidura macroura. Mourning Dove. Common summer resident in the broad, open valleys of the lower St. Joe, St. Maries, and Palouse rivers. April to September. Occasional stragglers noted in the high mountains in fall.

Bubo virginianus. Horned Owl. Fairly common resident throughout the mountains and timbered areas. Most specimens examined appear to be typical *B. v. lagophonus*, but a paler, grayer race or color phase has been noted in the mountains of the Main Division in summer.

Nyctea nyctea. Snowy Owl. While I have never seen either a live or a freshly-killed specimen from this locality, there are at least a few mounted specimens in existence which undoubtedly came from the St. Joe region. In 1931 I examined one which had been shot near Emida the winter before and mounted by Ranger L. A. Williams, then of St. Maries.

Glaucidium gnoma. Pigmy Owl. Probably resident; presumably confined to the heavily-timbered areas in the breeding season and frequenting the edges of marsh and willow or cottonwood thickets in fall and winter. Actually I have seen them only in the latter season, at which time they appear to be common in the vicinity of St. Maries. I have heard what I feel certain is the note of this owl in the mountains of the Main Division in summer, and likewise in St. Maries in the late fall.

Scotiaptex nebulosa. Great Gray Owl. Forest Ranger C. H. Scribner reports shooting an adult and an immature specimen along the trail between Roundtop and Fishhook Peak in the Main Division in the summer of 1924. A mounted specimen at St. Maries was reported to have been shot near Santa during the "bird hunting season" of 1924 or 1925. On June 24, 1931, I saw the wings and claws of two freshly-killed specimens (an adult and a half-grown young), which according to the Forest Service "smokechaser" who shot them, were taken the day before at "Forty-nine Meadows" which is just west of Roundtop Ranger Station. I have on numerous occasions heard what I believe is the note of this owl in the mountains of the Main Division. It is a single, deep-toned hoot.

Asio flammeus. Short-eared Owl. While this species is sometimes quite common, at least in winter, on the Palouse prairies to the westward, I have but a single record for the St. Joe Forest. On July 26,

1935, while driving over the Forest Service road between Avery and Roundtop Ranger Station, one of these owls flushed from the ground and flew ahead of my car at radiator height. At twenty miles per hour I was able to keep within a few feet of the bird, in fact I bumped it slightly once, causing it to swerve from its course and alight at the edge of the road. The owl was out of its element in this heavily-timbered area, and evidently bewildered.

Chordeiles minor. Nighthawk. Common summer resident, breeding throughout the lower altitudes. The last migrant to appear, usually arriving between the 5th and the 12th of June. Departs the latter part of August, although migrating flocks are sometimes seen as late as September 15. Noted rarely in the mountains.

Chaetura vauxi. Vaux Swift. Summer resident, probably breeding locally in the mountains. Noted occasionally as a migrant in the lower country. May to early September.

Archilochus alexandri. Black-chinned Hummingbird. Uncommon summer resident. May to July. Noted only at St. Maries.

Selasphorus rufus. Rufous Hummingbird. Common summer resident, generally distributed throughout the entire forest region. Arrives about the first of May and remains until early September. By far the most common of our hummingbirds.

Stellula calliope. Calliope Hummingbird. Fairly common summer resident in the mountains; has been noted near St. Maries, although not actually in town. Arrives in May and probably leaves in late August or early September, but the species is difficult to distinguish from the Rufous after the adult males disappear in July.

Megaceryle alcyon. Belted Kingfisher. Common summer resident along streams and lakes. April to November. Occasionally winters.

Colaptes cafer. Red-shafted Flicker. Very common resident. Widely distributed during the summer, often appearing at extremely high altitudes. In winter it is confined to the lower valleys where its occurrence is regular.

Ceophloeus pileatus. Pileated Woodpecker. Fairly common resident in the yellow-pine belt of the Palouse Division. More restricted but not rare in the larch-fir association of the Main Division. Wanders in fall to the highest mountain tops and has been seen in the town of St. Maries.

Asyndesmus lewis. Lewis Woodpecker. Common summer resident in open timber of the Transition Zone. May to September. Commonly wanders to high altitudes through open "snag areas" in the early fall.

Sphyrapicus varius. Red-naped Sapsucker. Fairly common summer resident in Canadian-Zone forests and often noted at low altitudes in migration. April to late September.

Dryobates villosus. Hairy Woodpecker. Common resident, widely distributed. Favors the Canadian-Zone forests in the breeding season but I have also found it nesting on cottonwood flats near St. Maries.

Dryobates pubescens. Downy Woodpecker. Fairly common resident among cottonwood growth in the low valleys. Rarely penetrates the conifer belt and never to high altitudes.

Picoides arcticus. Arctic Three-toed Woodpecker. Rather uncommon resident of the Canadian Zone forests. Much commoner in the Lochsa country forty or fifty miles to the south.

Tyrannus tyrannus. Eastern Kingbird. Very common summer resident in the open Transition Zone. Extends its range through heavily-burned areas to include the lower mountain slopes. Arrives about May 20 and leaves in late August.

Empidonax traillii. Traill Flycatcher. Summer resident of local and fluctuating abundance. Usually not very common. Confined during the breeding season to willow-bordered mountain streams or brushy deciduous growth in the larger valleys. May to early September.

Empidonax hammondi. Hammond Flycatcher. Common summer resident throughout the Transition Zone and on the edges of mountain meadows in the lower Canadian. May to September.

Empidonax difficilis. Western Flycatcher. Rather uncommon summer resident. Noted infrequently and at widely separated localities, usually along the larger streams in the mountains. May to August.

Myiochanes richardsonii. Western Wood Pewee. Common and widely distributed summer resident in the Transition Zone, particularly about parks, orchards and city shade trees. Late May to early September.

Nuttallornis mesoleucus. Olive-sided Flycatcher. Common summer resident in the mountains. Typical of the snaggy burned areas about the edges of mountain meadows in the Canadian Zone. Occasional at lower altitudes in migration. Late May to September.

Otocoris alpestris. Horned Lark. Large, pale Horned Larks with scarcely a tinge of yellow have been noted on high ridge-tops in the fall. They apparently are of the race *arcticola* and have been seen only on barren mountain peaks, open ridge-tops and occasionally in alpine meadows on the Main Division in September and early October. Should be looked for in the lower country in winter as I have observed such larks at this time in the Clearwater Valley.

The Dusky Horned Lark (*merrilli*) is the resident form throughout the "Palouse Country" where it is common, especially in summer. In the St. Joe region it has been noted only in the extreme western part, near the base of the Moscow Mountains.

Tachycineta thalassina. Violet-green Swallow. A common and widely distributed summer resident. Common at St. Maries, although outnumbered greatly by the Tree Swallow. In the higher mountains it is the only species of swallow likely to be seen. Arrives in late March and departs in August.

Iridoprocne bicolor. Tree Swallow. Very common summer resident in the broad valleys and open country of the Palouse. Abundant at St. Maries and noted up the St. Joe River to Avery. Arrives in the last half of March and leaves in August.

Stelgidopteryx ruficollis. Rough-winged Swallow. Fairly common summer resident. Noted in suitable locations along the entire length of the St. Joe and St. Maries rivers, but never in very great numbers. Late April to August.

Hirundo erythrogaster. Barn Swallow. Rather uncommon about St. Maries, Clarkia, and the upper Palouse. Extremely rare elsewhere on the St. Joe River, although it becomes common a short distance westward. Nested at Clarkia in June, 1933. May to early September.

Petrochelidon albifrons. Cliff Swallow. Locally common summer resident in open agricultural areas. Nests at St. Maries, Calder, Clarkia, and elsewhere in the Palouse Division. Late April to late July.

Perisoreus canadensis. Canada Jay. Locally common resident in the more densely timbered areas of the Canadian Zone, from the western border of the Forest to the Montana line.

Cyanocitta stelleri. Steller Jay. Common resident throughout the forested areas at all altitudes, and to some extent even in the extensive "burns."

Pica pica. Magpie. Irregularly common resident in the broad valleys of the western part. In fall individuals sometimes appear on open ridges far back in the mountains.

Corvus corax. Raven. Not uncommon resident in the high mountains, wintering along the larger streams but confined to the wilder situations.

Corvus brachyrhynchos. Crow. Common summer resident in open, agricultural sections. March to October.

Nucifraga columbiana. Clark Nutcracker. Common resident of the high mountains. Frequently noted at lower altitudes in fall and winter.

Penthestes atricapillus. Black-capped Chickadee. Common resident of the Transition Zone, extending upward to about 4000 feet altitude. Favors willow and other deciduous growth.

Penthestes gambeli. Mountain Chickadee. Common resident of forests of subalpine type at high elevations. Extends its range to somewhat lower altitudes in winter but favors conifer instead of deciduous growth.

Penthestes rufescens. Chestnut-backed Chickadee. Common resident of Canadian and upper Transition zones. In summer its range is typical of the white pine forest and lies midway between the ranges of the other two chickadees. In spring and fall it overlaps the ranges of both species and in winter it is sometimes seen in St. Maries, but at all times this is strictly a bird of the coniferous timber.

Sitta carolinensis. White-breasted Nuthatch. Uncommon; probably resident but not noted in midwinter. I have seen individuals on infrequent occasions in the yellow pines of the Transition Zone and among the white-barked pines of the Hudsonian Zone, but never in the intervening areas.

Sitta canadensis. Red-breasted Nuthatch. A common and widely distributed resident, but irregular in its appearance in any given locality. One of the commonest summer birds in Canadian Zone forests of the Main Division. I have seen them in St. Maries in every month of the year and at altitudes of 6000 feet or higher in midwinter.

Certhia familiaris. Creeper. A rather uncommon resident. Breeds in the Canadian Zone and winters usually at lower levels. Occasional at St. Maries in the winter. These birds are much more common in the more extensive cedar-white fir forests of the Lochsa region, forty miles south of here.

Cinclus mexicanus. Dipper. Common resident along rapidly flowing streams in the mountains of both divisions.

Troglodytes aëdon. House Wren. Common summer resident. Generally speaking, a Transition-Zone species, but often noted at rather high altitudes where burned and brushy areas prevail. Late April to mid-September.

Nannus hiemalis. Winter Wren. Fairly common summer resident in Canadian-Zone spruce forests and quite frequently noted in winter along the larger streams.

Telmatoodytes palustris. Long-billed Marsh Wren. Noted once in a marsh near St. Maries, October 3 and 4, 1936.

Salpinctes obsoletus. Rock Wren. Common summer resident among rock slides and outcroppings on high, open ridge tops from mid-June to early September. Between June 4 and July 3, 1936, individuals were noted frequently and in unusual situations near St. Maries. I have never recorded this species in that locality at any other time (Auk, 54, 1937:97-98).

Dumetella carolinensis. Catbird. Common summer resident among deciduous growth along the main rivers. Especially common in the vicinity of St. Maries and noted occasionally in brushy burns of the lower slopes in the Main Division. Arrives late in May and remains through September.

Turdus migratorius. Robin. Abundant summer resident throughout the mountains as well as in the lower valleys. Breeds up to 6500 feet or higher. Winters regularly but in varying numbers at the lower altitudes.

Ixoreus naevius. Varied Thrush. Common summer resident in Canadian-Zone forests. Frequently noted in flocks at lower altitudes during migrations. Appears regularly in spring at St. Maries in March and departs from its breeding grounds in the dense forests in October.

Hylocichla guttata. Hermit Thrush. I first became aware of the occurrence in Northern Idaho of a small race of Hermit Thrush (*H. g. guttata*?) in 1928. Following a May snowstorm on the Lochsa River, the appearance of large numbers of Hermit and Olive-backed thrushes in the river flats gave me the opportunity on numerous occasions to view the two species together at close range and always, the smaller, trimmer appearance of the Hermit was noticeable. Similar comparisons with the breeding subspecies of Hermit Thrush indicates a much larger bird. Another fact of note was the occasional appearance of these smaller thrushes a month or more after the last breeding Hermits had left. I find one record for the St. Joe as follows: October 9, 1931, two seen about six miles east of Monumental Buttes; watched for a considerable period at close range, they appeared scarcely larger than Song Sparrows. The larger breeding hermit thrush is rather local but is a common summer resident. It is confined to the upper Canadian and Hudsonian zones. Early June to early September.

Hylocichla ustulata. Olive-backed Thrush. Common summer resident throughout the timbered areas in the upper Transition and Canadian zones. May to September.

Hylocichla fuscescens. Willow Thrush. Common summer resident in the willow and cottonwood swamps along the lower St. Joe and St. Maries rivers. Late May to August.

Sialia mexicana. Western Bluebird. Rare. A pair seen near the mouth of the St. Maries River, April 3, 1932. These birds are quite common a few miles to the north and west in Kootenai County.

Sialia currucoides. Mountain Bluebird. Common summer resident everywhere except in densely-timbered areas. March to October. Nests at St. Maries and also near the tops of the highest peaks in the Main Division.

Myadestes townsendi. Townsend Solitaire. Not uncommon summer resident in the mountains, nesting in both Canadian and Hudsonian zones. In migration it appears at lower levels and not infrequently in the winter at St. Maries.

Regulus satrapa. Golden-crowned Kinglet. Common summer resident in Canadian-Zone forests. Winters at lower levels and to some extent in the mountains.

Corthylio calendula. Ruby-crowned Kinglet. Common summer resident in forests of Transition and Canadian zones. During spring migrations it is frequently abundant among shade trees in St. Maries and other towns in the vicinity. Arrives about the middle of April and leaves in October.

Anthus spinoletta. Pipit. Noted as a fairly common fall migrant, appearing on high, open ridge tops in the mountains and also in the meadows and mud flats near St. Maries. September and October.

Bombycilla garrula. Bohemian Waxwing. An irregular and roving, but often abundant, winter visitor. Generally very common at St. Maries and largely restricted to the Transition Zone, although I have seen it occasionally in the mountains in fall. November to March.

Bombycilla cedrorum. Cedar Waxwing. Common summer resident at lower altitudes in the agricultural region. Occasional in the mountains in late summer and early fall. May to September.

Lanius borealis. Northern Shrike. Irregular but usually not uncommon winter visitor in open situations in the lower valleys. Noted rarely in the mountains in fall. October to March.

Vireo solitarius. Solitary Vireo. A rather common summer resident in coniferous forests of Canadian and Transition zones. Early May to September.

Vireo olivaceus. Red-eyed Vireo. Common summer resident in deciduous growth of the Transition Zone. Especially common near St. Maries. Late May to August.

Vireo gilvus. Warbling Vireo. A rather common summer resident in deciduous growth and to some extent on burned and brushy slopes in the mountains. Most common in the broad, low valleys. May to September.

Vermivora celata. Orange-crowned Warbler. Apparently an uncommon migrant, but perhaps overlooked among more noticeable species. Noted in brushy areas on both divisions. May and August.

Vermivora ruficapilla. Calaveras Warbler. Rather uncommon migrant. Possibly breeds in the Transition Zone along the Little North Fork of the Clearwater. Late April and May; July and August. A few June records. This species is a common summer resident forty miles to the southward.

Dendroica aestiva. Yellow Warbler. Very common summer resident in the Transition Zone throughout the main valleys. Rare on the upper St. Joe; it does not penetrate the conifer belt to any extent. Early May to August.

Dendroica auduboni. Audubon Warbler. Common summer resident in forested areas at all altitudes; the most widely distributed of our warblers. Late April to October.

Dendroica townsendi. Townsend Warbler. Fairly common summer resident in the conifer forests of the Canadian Zone. Extends its range somewhat downward into the Transition Zone during migrations, but rarely seen except in conifer timber. May to late August.

Seiurus noveboracensis. Water-thrush. A restricted, but not rare summer resident. Noted only in the dense, willow and cottonwood swamps along the lower St. Joe and St. Maries rivers. May to August (Auk, 54, 1937:97-98).

Oporornis tolmiei. Tolmie Warbler. Common summer resident in damp, brushy situations throughout the Transition and Canadian zones. May to early September.

Geothlypis trichas. Yellow-throat. Common summer resident along the lower St. Joe, St. Maries and Palouse rivers. May to late September.

Icteria virens. Chat. Rare, probably accidental. A pair noted May 26 and 27, 1937, on the outskirts of St. Maries.

Wilsonia pusilla. Pileolated Warbler. Common summer resident about the edges of mountain meadows and willow-bordered streams in the Canadian Zone. Frequently noted in migration at considerably lower altitudes. May to mid-September.

Setophaga ruticilla. American Redstart. Common summer resident along the larger watercourses in the western part. Noted rarely up the St. Joe River to Avery. Mid-May to late August. Especially common in the vicinity of St. Maries.

Passer domesticus. English Sparrow. Common resident about towns and ranches. Individuals occasionally seen about permanent camps in the mountains, although never at high altitudes.

Dolichonyx oryzivorus. Bobolink. Rather common summer resident in meadows between St. Maries and St. Joe City. Not noted elsewhere. Late May to July.

Sturnella neglecta. Western Meadowlark. Very common summer resident in open areas along main watercourses of the Palouse division. Occasionally noted in mountain meadows far back from civilization. March to October. Rare in winter.

Xanthocephalus xanthocephalus. Yellow-headed Blackbird. Locally common in marshes near St. Maries and occasionally elsewhere. One record from Avery. Probably summer resident, but noted only from April through June.

Agelaius phoeniceus. Red-winged Blackbird. Very common summer resident in marshes of the lower St. Joe, St. Maries and Palouse rivers. Rare elsewhere. The earliest migrant to appear, often appearing in advance of the first migrating robins. February to October. Occasional in winter.

Euphagus cyanocephalus. Brewer Blackbird. Common summer resident in open valleys of the western part of the Forest. Rare elsewhere. April to October. A wintering flock noted at St. Maries during February, 1934.

Molothrus ater. Cowbird. Not uncommon summer resident in low valleys of the Palouse Division. Occasional individuals seen following saddle and pack horses and mules in the high mountain pastures. Most frequently noted near St. Maries. May to October.

Piranga ludoviciana. Western Tanager. Common summer resident in conifer forests of Transition and Canadian zones. May to September. Often seen on the outskirts of St. Maries.

Hedymeles melanocephalus. Black-headed Grosbeak. Common summer resident in partly-wooded valleys and brushy slopes of the Transition Zone, extending upward to high altitudes on favorable exposures. May to September.

Passerina amoena. Lazuli Bunting. Rather common summer resident, but somewhat local in distribution. Generally favors a similar habitat to the preceding species and like it, often extends its range up to five or six thousand feet in elevation on warm, exposed slopes. May to August.

Hesperiphona vespertina. Evening Grosbeak. Irregular, but usually common resident. Noted throughout the entire forest region in summer and in the lower valleys in winter. I have noted it in St. Maries in every month in the year, and, except in midwinter, on the highest mountain peaks.

Carpodacus cassinii. Cassin Purple Finch. Common summer resident through the entire area. One of the characteristic birds of St. Maries and equally common in the mountains of the Main Division. March or April to October.

Pinicola enucleator. Pine Grosbeak. Summer resident in the Canadian Zone of the Main Division; local but not rare. Irregular and generally uncommon winter visitor to the lower valleys, and, rarely, in the mountains. Breeding birds are probably *P. e. montana*, wintering flocks may contain *P. e. alascensis* or both races.

Leucosticte tephrocotis. Rosy Finch. Uncommon. A small flock seen at the top of "Potato Hill" near Deary, May 11, 1938, were definitely identified as of the race *littoralis*. I have found them to be more common in the Clearwater country to the south and southeast. Shaw (*op. cit.*) records them from the Moscow Mountains in spring. *T. t. tephrocotis* has been noted in spring and fall on the

middle fork of the Clearwater River and should occur among flocks of *littoralis* on the St. Joe Forest.

Acanthis linaria. Redpoll. Irregular winter visitor, usually absent from this region though noted commonly in the surrounding country. Seen frequently in flocks in March, 1936, in the vicinity of St. Maries.

Spinus pinus. Pine Siskin. Common resident throughout the area, but quite local in distribution during the winter. Its vertical range covers all altitudes. I have seen this species in every month of the year at St. Maries and on at least one occasion in the high mountains in midwinter.

Spinus tristis. Goldfinch. Common summer resident in the low valleys of the western part. April to November. Occasional in winter. Favors deciduous growth and does not occur in the mountains proper.

Loxia curvirostra. Red Crossbill. Resident of varying abundance. Never wholly missing from the yellow-pine areas of the Transition Zone, but may be either totally absent or very common in the mountains of the Main Division, depending on the cone crop. Usually most common from mid-July to October, but I have seen it in very large flocks in midwinter.

Loxia leucoptera. White-winged Crossbill. Probably resident, but even more irregular than the preceding species and generally much less common. Noted only on the Main Division where in "cross-bill years" they may for a time even outnumber *curvirostra* in abundance. Such a condition occurred from August 18 to September 14, 1930, and from July 15 to October 13, 1933.

Pipilo maculatus. Spotted Towhee. Rather common summer resident in brushy areas along the main watercourses, extending its range to moderately high altitudes on warm, south exposures. April to August.

Passerculus sandwichensis. Savannah Sparrow. Extremely local but not rare summer resident in wet meadows of the lower St. Joe and Palouse rivers. April to September.

Poocetes gramineus. Vesper Sparrow. Rare. Noted on the upper Palouse, September 5, 1935.

Chondestes grammacus. Lark Sparrow. Casual. Individuals noted as follows: September 10, 1922, Roundtop Ranger Station; June 20, 1931, Twin Creek Ranger Station; September 5, 1935, upper Palouse River.

Junco oreganus. Oregon Junco. A common and widely distributed summer resident throughout the entire area. Often abundant during migrations; winters irregularly but quite commonly at lower altitudes. Occasional dark, highly-colored individuals seen in the lower country in winter suggest that the coastal race, *J. o. oreganus*, may occur.

Spizella passerina. Chipping Sparrow. A common summer resident, found at all altitudes and in open spots in the dense forests as well as in the agricultural sections. Late April to September.

Zonotrichia leucophrys. White-crowned Sparrow. The status of the races *leucophrys* and *gambelii* not definitely established, but both known to occur. I believe that *Z. l. leucophrys* is a common summer resident, breeding in mountain parks in the Canadian and Hudsonian zones. Has been definitely recognized at lower altitudes in spring and fall. May to October. The race *gambelii* was positively identified only in September and on the Main Division, but it probably occurs elsewhere, and at other times.

Passerella iliaca. Fox Sparrow. Common summer resident in forests of Canadian and Transition zones. Late March to September.

Melospiza lincolni. Lincoln Sparrow. Locally common summer resident in the Canadian Zone, favoring brushy openings along willow-bordered streams in the mountains. This is one of the typical birds about the meadows at Twin Creek Ranger Station. May to early September.

Melospiza melodia. Song Sparrow. A common resident in the Transition Zone along the main watercourses. Rare straggler at the higher altitudes. Though appearing throughout the year at St. Maries, it is migratory and its numbers are greatly augmented in spring.

The following species include all of those not listed above which the author believes might reasonably be expected to occur on the St. Joe Forest. It does not include remote possibilities such as might be indicated by casual occurrence on one of the adjoining national forests. Neither does it include a number of species reported by Merrill and Rust from the vicinity of Coeur d'Alene and the St. Joe Marshes. A complete list swelled from the above sources and from the author's notes from the Clearwater Valley would bring the total well beyond 200.

Aechmophorus occidentalis. Western Grebe. Noted at Fish and Eagle Mountain lakes on the Clearwater Forest in October, 1928 (Condor, 34, 1932:23-25). Both Merrill and Rust record it from Coeur d'Alene Lake and it should be looked for in the marshes near St. Maries in fall.

Chen hyperborea. Lesser Snow Goose. Noted as a common migrant in the Clearwater Valley. Should cross northwestern Clearwater and southeastern Latah counties in the regular migrations of April, and of October and November.

Larus californicus. California Gull. Noted frequently in the Clearwater Valley in late summer, and in fall and winter. More than likely the species has been overlooked among flocks of *delawarensis* in the St. Maries region.

Picoides tridactylus. Three-toed Woodpecker. Local but not uncommon resident in forests of the Canadian Zone of the Lochsa district in the Clearwater Forest. Should occur in similar situations on the Main Division of the St. Joe Forest.

Empidonax wrightii. Wright Flycatcher. I am almost certain that I have seen this species on the St. Joe in migrations. However, lacking specimens I cannot verify its occurrence and it has no distinctive notes that I can identify with certainty. Both Merrill and Rust report it from Coeur d'Alene.

Sitta pygmaea. Pigmy Nuthatch. A common resident species at Coeur d'Alene and at Spokane, Washington. It seems only a question of time until it is noted in the yellow-pine forest near St. Maries or in the Palouse.

Icterus bullockii. Bullock Oriole. Fairly common in the Clearwater Valley and reported by both Merrill and Rust from the vicinity of Coeur d'Alene. That it formerly occurred near St. Maries is evidenced by a few of the durable nests which still may be seen in the cottonwoods along the St. Joe River.

Plectrophenax nivalis. Snow Bunting. Occasional in late fall and winter in the western part of the Clearwater Country. Reported by Merrill and Rust from the Coeur d'Alene region.

General comments.—In comparing the above data with my notes from the Lochsa country, approximately forty miles to the south, I find certain significant differences.

The St. Joe is typically a white-pine forest, lying near the geographic center of the type range in the northern Rocky Mountain region. On the other hand, the Lochsa River forms a rather definite southern boundary of the commercial white pine forests in Idaho. This condition is reflected in the abundance of the Chestnut-backed Chickadee as a breeding species in the St. Joe Forest, whereas it is recorded as an irregular winter visitor and possible rare breeder at similar altitudes on the Lochsa. Another condition which seems to be purely environmental in character is a decided increase in the relative abundance of species which favor the cedar-white fir timber in the Lochsa Canyon where that type of timber prevails in broad zones. The most notable of these are the Creeper, as a breeder, and the Winter Wren during the migratory seasons.

Other differences appear to be more geographic than environmental and include the following:

Goshawk and Pine Grosbeak. Frequently seen in summer and probably breed on the St. Joe. Noted only as rare migrants or winter visitors in the Lochsa country.

Vaux Swift. Common migrant along the Lochsa River as well as the Middlefork of the Clearwater, often appearing in large flocks. Irregular and uncommon at all times on the St. Joe. Summers sparingly on both forests in the mountains.

Calliope Hummingbird. Rather common summer resident on the St. Joe. Not noted during seven years of observation in the Lochsa region.

Rock Wren. Fairly common summer resident in the mountains of the St. Joe, appearing on rocky peaks at high altitudes. Noted only a few times in the Lochsa country and then at low elevations.

Bohemian Waxwing. Irregular, but often abundant winter visitor throughout the lower valleys of the western part of the St. Joe. Flocks noted only at rare intervals in the Lochsa or Clearwater regions.

Calaveras Warbler. Fairly common summer resident and quite widely distributed in the Lochsa country. Uncommon and extremely local, even as a migrant on the St. Joe.

Comparisons between the St. Joe and the adjacent Lolo and Cabinet national forests in Montana appear to offer other interesting variations in the abundance and distribution of certain species, but more study and observation are needed before conclusions can be drawn.

Missoula, Montana, June 20, 1941.

NON-GENETIC MATING PREFERENCE AS A FACTOR IN EVOLUTION

By JOHN E. CUSHING, JR.

The purpose of this paper is to consider some of the aspects of sexual isolation in birds as a possible step toward the "thorough understanding of the nature and functioning of isolating mechanisms" that Dobzhansky (1937a:419) emphasizes is essential before a "trustworthy picture of the mechanism of evolution can be drawn." By sexual isolation is meant the lack of sexual attraction between members of different populations, which lack inhibits to various degrees the amount of cross-mating between the groups involved. This type of isolation is but one of several listed by Dobzhansky (1937b) as physiological isolating mechanisms, all of which act as barriers to the free exchange of hereditary materials between populations. Various instances among birds where sexual isolation may well be involved have been reviewed by Huxley (1938a:7, 8, 10), Goldschmidt (1940:155), Mayr (1940:249-278) and others, and the existence of the phenomenon is known in other animals, for example in the mice of the genus *Peromyscus* (Dice, 1940:289-311) and among the species of flies in the genus *Drosophila* (Dobzhansky and Koller, 1938; Patterson, 1940; Spencer, 1940). However, in spite of the well established fact that such isolation exists, present knowledge of the details of its physiology is small.

Among birds and other higher animals, preferential mating rests on a complex basis involving the interaction of many factors. However, certain facts can be extracted from this complexity that prove useful in its analysis. Among these is the well known one that in some cases it is possible arbitrarily to classify the factors conditioning mating preferences into two groups, one consisting of those resting upon an hereditary basis, the other upon a non-hereditary one. The interaction of these two groups results in the establishment of a mating preference and hence may effect sexual isolation.

With relation to the above classification, one can expect two extreme types of mating preference. The first includes those cases in which preferential mating is based chiefly upon genetically controlled factors, capable of environmental modification only with difficulty if at all. The second includes those instances in which preferential mating is based largely upon non-genetically controlled factors, preferences being formed anew with each generation. Of course, between these extremes various intermediate relationships are possible; however, for the purpose of clarity and also because of lack of analysis of such intermediate cases, we will confine further discussion to the extremes.

The cowbirds represent a good example of the genetic extreme in birds, for in the parasitic species of this group it is apparent that young birds, separated from their parents before birth, probably inherit the ability and desire to mate with their own kind. One should note though that Friedmann (1929:70) observed three instances where males of *Molothrus bonariensis* displayed to birds of other species, which suggests that even in the cowbird the genetical group of factors may be capable of some modification. As far as our knowledge goes, however, there seems to be no reason to believe that non-hereditary factors are of importance in the establishment of the mating preferences in cowbirds, for, if they were, the species could not enjoy their peculiar habits and survive. Because sexual isolation at the genetic extreme just noted for cowbirds also occurs in *Drosophila* and has been discussed by Dobzhansky in several publications (1937b and 1940), the remainder of this paper will be concerned with the non-genetic extreme.

Dobzhansky (1937a:237) writes that Serebrovsky and co-workers have obtained large deviations from the normal behavior in domestic animals through experimentation. One of the examples quoted is that "male turkeys were induced to attempt copu-

lation with fowls," and in general, it is stated, that many otherwise unobtainable hybrids can be obtained by such experiments. Further evidence of a non-genetic extreme has been furnished by Whitman (1919), who has shown that the social environment of pigeons conditions their mating preferences almost entirely. These observations have been summarized (p. 98) as follows: "Pigeons normally pair with members of their own species and this preference has generally been regarded as instinctive in character. But the data of this volume show rather conclusively that the species preferences exhibited by birds [pigeons] at maturity are to a large extent acquired and are functions of the social environment in which the birds are reared. We are told that young birds raised under foster parents of a different species are very apt to prefer a mating not with their own kind, but with a member of the species among which they have been reared." It is pointed out that knowledge of this property of pigeons had much to do with success in obtaining a great variety of interspecific hybrids. The words "very apt" in the above quotation suggest that the method is not infallible; however, one can see that pigeons are apparently quite close to the non-genetic extreme and form a sharp contrast with the cowbirds.

Whitman's work on pigeons illustrates another point important to this paper, namely, that the mating preference, while acquired, apparently becomes fixed at an early stage in the life of the bird, long before sexual maturity. A limited period of plasticity seems to exist, during which a particular preference can be established and after which it can only be altered by special experimental techniques. The ease with which such a preference can be broken down after it is once fixed may, of course, vary. That it may be broken with difficulty is seen in the specific case of the male passenger pigeon (*Ectopistes migratorius*) reared by ring doves (*Streptopelia* sp.) which would make no advances to females of its own species even after being removed from the company of female ring doves for a whole season (Whitman, 1919:28). This same kind of fixation has been observed by Barrington and others in those birds that acquire their songs (Wallace, 1895:104). Such birds learn the song of their parents, foster or normal, early in life and these songs rapidly become "fixed" and unmutable shortly after this.

The work of Lorenz (summary, 1937) furnishes much additional evidence on the non-genetic nature of the specificity of mating, of the following-reactions and other activities of birds other than pigeons, and also on the phenomenon of early fixation and subsequent rigidity of such acquired behavior. The widespread occurrence of such conditioning is indicated by the species referred to by Lorenz, which are: great horned owl, South American bittern, raven, greylag goose, muscovy duck, mallard duck, partidge, jackdaw, and shell parakeet.

In summary, we see that in many species of birds there exists a mechanism for the establishment of mating preferences, the specificity of which appears to be largely non-heritable and needs to be re-established and fixed early in each generation.

The existence of such a mechanism opens the way to some speculation, for, given a species with its breeding population broken into sub-units, all that seems necessary in order to reduce the number of successful matings of migrant exchanges between sub-units is that the factors conditioning sexual preferences come to vary among these sub-units. Such variation should elicit different mating responses, which, if more or less permanently established before the young leave their parental influences, should result in an isolation. Such an isolation would be as strong as the conditioning factors are different within the populations involved. The greater the differences, the less apt the conditioned young would be to recognize and react to stimuli in a group other than their own. The extent to which differences in conditioning factors between populations

can accumulate and thus increase the strength of the sexual isolation involved is unknown.

The nature of these conditioning factors and the causes of their variance undoubtedly differs from species to species and any detailed treatment is beyond the scope of this paper. Such characters as color, voice, size, and particular mannerisms are probably concerned. The variance of these among sub-populations can be the result of mutation, with or without selection (the latter when the conditioning genes become fixed in a sub-population through random fluctuations in the manner discussed by Wright, 1931:201-208), or possibly even the result of environmental influences without the aid of genetic change. This last possibility is suggested by the refusal of some birds to breed in captivity unless the proper background or nest materials are provided, by the fact that others breed better or sooner depending upon population size (*Huxley*, 1938b:18-19), and by the possibility that some birds acquire their songs from their parents (*Wallace*, 1895).

As it is evident that the existence of the sexual isolation under discussion is made possible by the presence and change of conditioning factors, some persons may prefer to consider them as the true isolating mechanism. However, the fact remains that at the preference level itself, some kinds of birds appear to inherit their mating preferences while others acquire them. This difference should not be disregarded as a possible influence in their evolutions, for the re-enforcing by sexual isolation of any geographical or ecological isolation arising within a population would seem to be more readily attainable by species with non-genetic mating preferences than by those with genetic ones. In this connection a further point should be made. As there is evidence to suggest that the conditioning factors themselves may sometimes depend for their specificity upon an environmental basis, it is conceivable that an initial sexual isolation may arise entirely as the result of environmental influences without the occurrence of genetic change. Although such isolation would seem to be of a relatively weak and temporary nature, it could nevertheless be of potential advantage, at least in the earlier stages of speciation, by helping to provide a proper degree of semi-isolation between sub-populations, for Wright (1931:208) conceives of a population broken "into small, incompletely isolated groups" as one best deployed "not merely for branching of the species, but also for its evolution as a single group."

One phenomenon in need of investigation from the point of view suggested by Whitman's and Lorenz's work is that of "double invasions" of oceanic islands as described by Mayr (1940:271). In such invasions, the same species is known to have successfully immigrated to an island at two different times, the two populations, however, behaving as distinct species and not interbreeding. Of special interest here is the double invasion of the western Canary Islands by a pigeon which now exists there as the forms *Columba laviovera* and *C. bolli*. Study of such cases may result in a more modern interpretation of the old general idea (see for example, Baldwin, 1902; and Gulick, 1905) that acquired non-heritable behavior may have some influence upon the evolution of the forms possessing it. This of course does not mean that such behavior comes to be inherited in time, but rather that it is a factor that can affect the population mechanics with respect to heritable characters.

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California Institute of Technology, Pasadena, California, March 17, 1941.

EXPERIMENTS ON THE COLOR PREFERENCE OF BLACK-CHINNED HUMMINGBIRDS

By FRANK BENÉ

In the notes of field workers and in the remarks of casual observers, the statement is frequently made that hummingbirds are partial to red objects and flowers. Red is regarded as the predominant color in hummingbird flowers, implying thereby that in the Trochilidae there is an inherent attraction for red. The purpose of this paper is to inquire into the validity of this assumption.

Experiment 1.—In Phoenix, Arizona, on March 14, 1940, the writer tested the color preference of an adult female Black-chinned Hummingbird (*Archilochus alexandri*) that since February 26 had been visiting and feeding from amber-colored honey glasses at intervals during the day of from 15 to 45 minutes. When deprived of these feeders, she would visit the lilac-colored blooms of the butterfly bush (*Buddleia farquhari*), and more often the orange corollas of an *Aloe*, but she ignored the profusion of orange, scarlet, maroon, and yellow nasturtiums. This bird had probably been feeding from the honey glasses in the previous year, for on the day of her arrival from the winter range she flew to the honey glass the moment I placed it at her disposal.

Five one-ounce wine glasses were filled with syrup having a concentration of two teaspoonfuls of sugar in one ounce of syrup. The syrup in one glass was left uncolored while the syrup in the remaining containers was colored with tasteless food dyes, such as are used in pastry cookery. No more than two feeders were exposed to the bird at one time, so that on each visit to the feeders she had to choose one of two, thus indicating her color preference. Placed in a shaded spot, the colorless, yellow, orange, and green feeders were exposed for five trips and the red feeder for twenty trips. Obviously, red had an exposure advantage four times more than any other single feeder. The bird's choice is given in the following table:



Fig. 64. Female Black-chinned Hummingbird probing *aloe*; bird used in experiment 1.

TABLE I
Color preference of female adult Black-chinned Hummingbird

Order of trips to feeders	Time of arrival	Reaction
		(Choice of red and colorless syrup)
1	8:22	Colorless chosen
2	8:41	Colorless chosen
3	8:52	Red chosen first, colorless second
4	9:02	Colorless chosen
5	9:17	Colorless chosen
		(Choice of red and orange)
6	9:38	Red chosen first, orange second
7	9:51	Red chosen
8	10:13	Orange chosen
9	10:25	Orange chosen
10	10:38	Orange chosen

Order of trips to feeders	Time of arrival	Reaction
		(Choice of red and yellow)
11	11:19	Yellow chosen
12	11:37	Red chosen first, yellow second
		(Choice of red and green; red feeder is placed on stand previously occupied by colorless, orange, and yellow feeders. Green feeder is placed on stand previously occupied by red feeder.)
13	12:12	Green chosen
14	12:27	Green chosen first, red second
15	12:40	Red chosen
16	1:14	Green chosen
17	1:24	Green chosen
		(Choice of red and yellow)
18	1:49	Yellow chosen
19	2:09	Yellow chosen
20	2:29	Yellow chosen

If we assign to first choice a value of 3, to second choice, 2, and give red one-fourth value by reason of its advantage of exposure, the colors have the following values of preference:

	Colorless	Yellow	Green	Orange	Red
First choice	12.0	12.0	12.0	9.0	3.75
Second choice	2.0	2.0	2.0	.5
Total value	14.0	14.0	12.0	11.0	4.25

Of significance is the bird's reaction to the feeders, which is not given in detail in the table. On the third trip the bird paused at the red syrup, dipped her bill into it, then quickly withdrew, moving over to the colorless feeder to drink contentedly. The bird appeared quite satisfied with the colorless, orange, yellow, and green feeders, preferring these to red, but she was impelled to sample red syrup on the third, sixth, seventh, twelfth, and fifteenth trips.

Because the red feeder received such scant attention for the first twelve trips, the experimenter was convinced of the bird's indifference to red. Therefore, to put red at an advantage over the other feeders, he placed the red feeder on the stand previously occupied by feeders other than red. Also, to detract the bird from the yellow feeder, a green feeder was substituted for the yellow, after the yellow feeder was exposed for only two trips (later yellow was given three more exposures). But even this change failed to draw the bird to red, for up to and including the twentieth trip the bird hardly visited the red syrup.

Experiment 2.—On April 5, 6, and 8 of 1941, a second experiment was carried out. This time the subjects were two male adult Black-chinned Hummers. Unlike the female of the previous experiment, these birds preferred sugared water to commercial honey. Before participating in the experiment, they had been feeding regularly from syrup glasses, one bird since March 24, the other since March 27. Before this the birds would sample vials of honey hidden in beds of nasturtium. As long as the vials were disguised with nasturtium blooms so that the color of the contents was concealed, the birds showed no marked preference for one over the other. But when the disguise was removed, they unmistakably chose the colorless syrup and rejected the amber-colored honey solution. Between feedings from the syrup glasses, which the birds were in the habit of visiting, they would indiscriminately probe the maroon, scarlet, salmon pink, yellow, and orange nasturtiums. Occasionally they fed from the white flowers of the shrimp plant (*Beloperone guttata*) of which two small bushes were available. Frequently they visited the

white blossoms of orange and grapefruit trees and the pink-white blossoms of the lemon tree. Before these flowers were in bloom, they had been visiting the *Buddleia*.

Two new coloring dyes, violet and blue, were added to the battery used in the experiment of the previous year, so that a total of six colors was available to the birds. No colorless syrup was used, because in a preliminary test the birds would ignore the colored feeders, giving exclusive patronage to the colorless syrup from which they had been trained to feed. Altogether six colored feeders, displaying all the colors of the solar spectrum, were arrayed before the birds at one time, as shown in the accompanying illustration (fig. 65). From time to time the position of the feeders in the battery was changed to prevent the birds from forming habits of position.



Fig. 65. Battery of colored feeders (green, red, violet, blue, yellow, orange) used in experiment 2. Adult male Black-chin is sampling orange syrup.

Unlike the female bird of the first experiment, these males were extremely wary of the colored feeders, so that it was necessary to continue the experiment over three days until a total of twenty-six visits was made. The experimenter sometimes had difficulty in distinguishing the individuals, and for this reason we shall deal only with their collective choice of colors, as shown in table 2. The same procedure of weighting choices was used as in the first experiment.

Comparing the color preference of the female Black-chin with that of the males, we note that in both cases yellow ranks high.

TABLE 2
Color preferences of two adult male Black-chinned Hummingbirds, showing choice of colors made on twenty-six trips. Choices weighted as follows: first, 3; second, 2; third, 1.

	Yellow	Orange	Red	Blue	Violet	Green
April 5						
First choice	3	6	9	3	9	0
Second choice	0	6	2	4	0	0
Third choice	1	1	0	0	0	0
Total	4	13	11	7	9	0
April 6						
First choice	24	6	0	0	0	3
Second choice	4	2	0	0	0	0
Total	28	8	0	0	0	3
April 8						
First choice	3	6	0	3	0	3
Second choice	2	2	0	0	0	0
Total	5	8	0	3	0	3
Grand total	37	29	11	10	9	6

Unlike the female, these males were very eclectic and capricious in their choice of colors. One of them had difficulty making up his mind on April 5, for he sampled three different feeders on each of two trips. The other tried two colors on each of the four trips on the same day. After this their minds were pretty well made up, for they seldom sampled more than one feeder on a trip. Also, after April 5 they were inclined to be more constant in their choice.



Fig. 66. Male Black-chin in flight.



Fig. 67. Male Black-chin drinking from colorless syrup glass.

At the time of the experiment, green and yellow predominated in the garden flora. Yellow blooms of jasmine hung conspicuously from three floral fences. The reds and yellows among the nasturtiums were equally abundant.

Color preference of Ruby-throated Hummingbird.—Using six uniform-sized sugar-water artificial flowers, Pickens (1941:100) found that Ruby-throated Hummingbirds (*Archilochus trochilus*) visited the artificial flowers in this order, according to frequency: violet, 46; red, pink, and white, each 37; green and blue, each 36; yellow, 34; orange, 32; maroon, 29. The number of birds used in the experiment is not given.

If red and maroon are grouped under "red," his birds exhibited a decided preference for red, with violet second. Of further interest in the investigation are the reactions of individuals to the color of flowers. Pickens writes: "A single Ruby-throated Hummingbird busy with a large *Abelia* clump conspicuously neglected some scraggly red salvia-like plants and a violet *Achimenes* growing near by." Another hummingbird (presumably a ruby-throated), "lantana-trained perhaps to look on red as the color of a dying flower, rose from its lantana clump to examine a red artificial flower but was never seen to drink."

COMPARATIVE DATA

It is interesting to note that the Ruby-throated Hummingbirds were most attracted to red and violet, which are located at the extreme ends of the solar spectrum comprising violet, indigo, blue, green, yellow, orange, and red, whereas the Black-chinned Hummingbirds preferred yellow, in the middle of the spectrum. These differences in color preference force us to ask whether color preference in animals below man is governed by the

light properties of the object itself, or determined by the structure of the rods and cones in the retina, or conditioned by individual experience and training. Answers to these questions would provide some basis for accepting or rejecting the assumption that partiality to red is a trait of the species, or of the family of hummingbirds. We turn to comparative data obtained in the investigation of color reactions in animals other than hummingbirds.

Color sensitivity.—In experiments to test the color sensitivity of the pigeon and domestic chick, Watson (1915) found the limits of spectral sensitivity of the pigeon to be approximately 420 and 712 $m\mu$; and for the chick 400 to 707.5 $m\mu$. The human eye is sensitive to monochromatic lights from 400 to 760 $m\mu$. If we may accept the figures for the pigeon and chick as true of the hummingbird, then the hummingbird is sensitive to all colors of the spectrum within the wave lengths given above.

It is generally agreed that for the light-adapted eye the maximal sensitivity lies in the yellow-green region, from 580 $m\mu$ to 530 μ (Woodworth, 1938:539-550). If the rods and cones were the sole factor in determining color preference, then the light-adapted animal would be most attracted to yellow-green, not red.

Color constancy.—Whether animals perceive the object color (the way an object absorbs and reflects light that strikes it) or the stimulus brightness (light intensity or illumination of the object) has been a subject of much investigation, but chiefly with humans as subjects. Locke (see Woodworth, 1938:605) found that of four Rhesus monkeys and five human adults tested, monkeys react more to object colors than to stimulus brightness. Also, his Brunswick ratios show that monkeys react more to object colors than do humans:

Human adults: .10, .13, .19, .23. Monkeys: .47, .53, .59, 65.

Brunswick ratio = $(R-S)/(A-S)$, where A = a numerical value for the object; S = a numerical value for the stimulus brightness; R = a numerical value for the response or actual match (of colors).

That this response to object color is a function of the cerebral cortex and hence can be conditioned by training has been demonstrated by a number of investigators of animal behavior.

Kohler (1917) experimented with seven- to eight-month old chicks. After training the hens to pick grain only from the darker of two sheets of paper, both under the same moderate illumination, he placed the darker paper in direct sunlight, leaving the lighter paper in the weaker illumination. The hens continued to pick up the grains from the dark gray paper, though it was reflecting more light than the white paper. The brightness ratio of grain to background remained unchanged.

Katz and Révész (see Woodworth, 1938:606) stained grains of rice a strong yellow and trained hens to pick up white grains from the mixture. Then with strong yellow light they illuminated the white grains placed on a white ground. Without hesitation the hens picked up the grains which were reflecting the strong yellow light. The yellow grains were not yellower than the ground.



Fig. 68. Adult male Black-chin probing red nasturtium.

Burkamp (see Woodworth, 1938:606) was interested in investigating (1) the color sense and (2) the color constancy of aquarium fishes (*Cyprindes*). His procedure was to train the fish to feed from a trough of a certain color and then test the fish to find whether it was able to pick this color from a collection of grays and other colors. The colors were illuminated with light of various intensities. His results show that (1) the fishes were definitely positive in the selection of colors, except for confusing between red and yellow, and that (2) they picked out the object color in very dim light better than can the human observer.

CONCLUSIONS

1. Black-chinned hummingbirds are not attracted to red more than to any other color.
2. Color preference may be conditioned by training, as when a hummingbird trained to feed on colorless syrup remains constant to it, even when the colorless syrup is placed among feeders containing syrup of different colors.
3. There is no justification to regard partiality to red as though it were a phylogenetic trait of a species of hummingbird or of the family Trochilidae itself.

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Phoenix, Arizona, July 1, 1941.

THE CALIFORNIA SHRIKE IN THE NORTHWEST COASTAL BELT

By JOHN W. SLIPP

In his monograph on the American shrikes, Miller (1931:79) summarized the occurrences of the California Shrike (*Lanius ludovicianus gambeli*) in the northwest coastal belt of California, Oregon, Washington, and British Columbia as follows: "There are records of the race occurring at Humboldt Bay, California (Townsend, 1887, p. 222), at Gray's Harbor, Washington (Lawrence, 1892, p. 46), and in the Chilliwack district (Brewster, 1893, p. 237) and on Vancouver Island (Fannin, 1891, p. 39), British Columbia." Another old record (pointed out by Dr. Miller) is that of Woodcock (1902:83) who listed the species as being uncommon in late fall, winter and spring at Corvallis, Oregon. More recently Jewett (1934:51) has reported a female in breeding condition taken March 19, 1934, and a sight record for April 23, 1922, both in the vicinity of Medford, Oregon; and Edson (1935:13) has recorded a specimen taken April 2, 1931, in the western part of Skagit County, Washington, by E. J. Booth and identified by Dr. Joseph Grinnell. To the above may now be added the following two unpublished records from western Washington.

In the S. F. Rathbun collection at the Washington State Museum at Seattle there are parts of a specimen in an envelope on which is written the following in pencil: "S. F. Rathbun, Seattle, *Lanius l. gambeli*, ok HCO." In ink there is written "California Shrike, what was left of bird brought in by a cat, April 11, 1915. Sex not known. Taken 2 miles north of Seattle city limits." Mr. Rathbun himself tells me that this bird, the first to be taken in western Washington, was actually collected by him on the above date, and that it was spoiled by a cat after having been put in a supposedly safe place over night. As much as could be salvaged was sent to Dr. H. C. Oberholser who confirmed the original identification. I am indebted to Mr. Rathbun for telling me about this record and to him and Mrs. Martha Reekie Flahaut for permission to report it at this time.

A more recent record is that of a young male collected November 24, 1938, on the tideflats at Tacoma, Pierce County, Washington, by the writer. This specimen measured 8.12 inches in length, and is now in the collection of E. A. Kitchin at the College of Puget Sound. On skinning, it was found to have only the left testis developed; the stomach was packed with the remains of insects and some species of small mammal. Dr. Miller has confirmed the original identification in this case, writing me as follows: "The bird is a fairly typical first-year male of the race *gambeli*. There is, perhaps, a little sooting of the white plumage, but nevertheless it clearly shows the characters of this race."

In considering the nine locality records just listed, it may be pointed out that five are based on specimens collected whereas the status of the remaining four (Vancouver Island, Grays Harbor, Corvallis, and Humboldt Bay) is more or less problematical. Concerning the validity of the Vancouver Island occurrence, which was recorded simply as "Vancouver Island, A. H. Maynard" by Fannin (1891:39), Dr. Ian McTaggart Cowan has written me under date of October 30, 1940, as follows: "Most of Maynard's specimens are in the Provincial Museum but there is no shrike of this species represented there. Consequently, the record is open to doubt because nowhere in the literature is it definitely stated that the specimen was taken." At Grays Harbor the species was considered by Lawrence (1892:46) to be "Resident? rare," but it seems evident that no specimens were collected, and any sight records he may have had, with one exception to be considered later, were very likely based on the Northern Shrike (*Lanius borealis*)

which is not represented in his list. The latter weakness does not apply to Woodcock's (1902:83) listing of the species *ludovicianus* as uncommon at Corvallis in late fall, winter, and spring, but it is equally true that he did not cite any definite records, nor indicate the nature of his information. In a recent letter from Mr. Jewett it is stated that "Mr. Woodcock died in Corvallis, Oregon, many years ago," so the chance of learning anything further about his records appears remote. Townsend (1887:222) likewise did not state, in recording the species as rare in December at Humboldt Bay, whether or not specimens were taken. Replying to a query on this point, Dr. Townsend writes under date of April 10, 1941, that he does not now remember the facts of the case, "the bird having been taken over half a century ago. The specimen should be in the U. S. National Museum" (*italics mine*). From this it may be inferred that a specimen probably was collected, but I have been informed that there is no record of such a specimen (nor of any others from the Pacific northwest coastal belt) in the National Museum collections (letter of May 8, 1941, from J. E. Graf, Associate Director).

Of the five records definitely known to be based on collections, four represent March and April birds, while one, the Tacoma specimen, was taken late in November. The latter, therefore, represents the only positive fall record for the coastal belt, at least north of Oregon. The locality in this case is about 1000 miles north and west of the principal winter range ascribed to this race by Miller (1931:79), and the date, November 24, is ten days later than the latest fall date reported by Gabrielson and Jewett (1940:489) for Oregon (Harney County, southeastern quarter of state); these considerations make it seem likely that the bird would have wintered in the northwest had it not been killed. It may be noted incidentally that Mr. Jewett now has a sight record of this species for Oregon, again in Harney County, made December 20, 1935 (personal corresp.).

Seemingly but two of all the records here considered represent the California Shrike as anything more than a casual visitant in the northwest coastal area. Lawrence's (1892:46) belief that it might be resident about Grays Harbor was not considered valid in the discussion above, but his specific report of three shrikes seen June 10, 1890, in a small clearing on the Humptulips River is more acceptable, and suggests that the species may have bred in western Washington in historic times. Such a group at that season would presumably be of a family nature; and the assumption receives some support from the number of west-of-the-mountains records for March and April, when breeding activities should be getting under way. Prima-facie evidence that the species breeds or has bred in the vicinity of Medford in southwestern Oregon is supplied by Jewett's (1934) more recent reports, but the ecological contrast between the Upper Sonoran Zone of that area and the humid Transition of western Washington is notable, and argues against a parallel in the occurrence of breeding shrikes.

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NOTE.—Under the heading *Collyrio borealis*, J. K. Lord, in an article entitled "List of Birds collected by J. K. Lord, F.Z.S., and presented by the British North American Boundary Commission to the Royal Artillery Institution" (Minutes of Proceedings of the Royal Artillery Institution, Woolwich, England, 4, 1865:117), lists three collections, as follows:

- A male killed at Colville in November measured 10½ in.
One on a high divide above the Osoyoos lakes 9¼ in.
A male on the Sumas prairies measured 9 in., killed in June.

Lord states further that he at first "imagined" that he had two species, but later attributed the differences to age and sex variations. Although the Colville (Washington) bird doubtless was an example of *Lanius borealis*, it appears equally certain that a shrike 9 inches long, taken in June on the Sumas prairies, could only be *L. l. gambeli*, thus constituting the first record of that species for the northwest coastal belt. Also, this and the Osoyoos record are apparently the earliest records of the species in British Columbia, where it is considered (Brooks and Swarth, Pac. Coast Avif. No. 17, 1925: 106) only a "rare straggler" into the extreme southern portions of the province. The June occurrence at Sumas bolsters the possibility of the California Shrike's having occasionally bred in the humid northern portions of the coastal belt. Unfortunately the Lord reference was not found until too late for inclusion in the foregoing discussion.

Washington State Museum, Seattle, Washington, May 27, 1941.

FROM FIELD AND STUDY

Young California Black Rails.—The California Black Rail (*Creciscus jamaicensis coturniculus*) is sufficiently rare that even small contributions to its life history may be worthy of record. On May 10, 1941, I accepted the offer of an oological enthusiast to show me the nest of one of these birds in a slough near the south end of San Diego Bay, the eggs in which were about to hatch. Knowing of my interest in bird photography, it was his idea that I might be successful in securing a picture of the owner.

The eggs, pure white with tiny spots, and five in number, all seemed alive, as faint chirps could be heard from within. While the camera was being set up, the rail put in an appearance by a short flight from one clump of salicornia to another. On that first day I waited five hours for her to return to the nest and finally gave up as darkness approached. Before I left I laid a tiny twig across the eggs. I decided that if this was moved before the following morning all was well, but that if it was still in place the nest had probably been deserted.



Fig. 69. Eggs and recently hatched young of the California Black Rail.

By daylight the following morning I was again on the spot and so was the twig across the eggs. Strangely, however, the calls of the imprisoned young still issued from the shells, two of which were pipped. From the salicornia near by the rasping call of one of the adults could occasionally be heard. The photographic siege started once again and lasted well into the afternoon. During this time both of the pipped eggs hatched without parental aid. I took the accompanying photograph (fig. 69), which I believe may be the first ever published of young California Black Rails.

It is my firm belief that these eggs were left unprotected for a full 24-hour period, although the parents were watchfully waiting in the thick foliage near by. My experience therefore supported published accounts of the sensitiveness of this rail to intrusions upon its nest. When the young were able to crawl, they seemed intent on going in one direction—that from which the calls of the adults were often heard.—LEWIS W. WALKER, *San Diego Society of Natural History, San Diego, California, June 9, 1941.*

Occurrence of the Flammulated Screech Owl at Lake Tahoe, California.—On June 2, 1941, while motoring along the old Al-Tahoe Road, just east of Rowlands Marsh, Lake Tahoe, El-dorado County, California, I noticed a small owl impaled on a barbed-wire fence. The bird had evidently struggled desperately, though ineffectually, to free itself after becoming entangled, and

when found, had been there for some time. On examination, it proved to be a Flammulated Screech Owl (*Otus flammeolus*), the sex of which could not be determined.

According to the records of both Mr. James Moffitt and of the writer, this bird has not been recorded previously from the Tahoe area. The specimen, now in the collection of the California Academy of Sciences, has been preserved as a complete skeleton, and thus will provide definite proof of the occurrence of this rare species in the Tahoe region.—MILTON S. RAY, *San Francisco, July 25, 1941.*

Yellow-billed Magpies on Coastal Slope of Santa Barbara County, California.—Linsdale (Natural History of Magpies, Pac. Coast Avif. No. 25, 1937:20) gives only two records since 1887 of Yellow-billed Magpies (*Pica nuttallii*) in coastal Santa Barbara County, California. These were both from the vicinity of Gaviota. In the course of several years I have known of a number of nestlings which have been brought from north of the Santa Ynez Mountains to Santa Barbara or its vicinity and raised in a semi-free condition. Individuals that became wild and independent always disappeared within a year or two, and usually much sooner. On July 3, 1941, however, about one mile north of Goleta (about six miles from Santa Barbara and two miles from the sea) I saw a flock of eight birds flying about in the tops of a group of eucalyptus trees under which I was standing. The magpies were very noisy and were being attacked by a pair of Western Kingbirds (*Tyrannus verticalis*) that succeeded in driving them off after about five minutes. The flock appeared to contain both adults and young (with shorter tails) and it seems likely from this fact, and from the date, that they had bred in the neighborhood. It is not known whether the presence of these birds is the result of man's activities, or whether they found their own way from the Santa Ynez Valley, where they are common, but it is interesting to note their appearance at this point near the type locality from which the species has long been absent.—RICHARD M. BOND, *Oakland, California, July 23, 1941.*

A Race of the Poor-will from Sonora.—A few years ago in considering the characters shown by a small series of Poor-wills from Bates Well, Pima County, Arizona (Trans. San Diego Soc. Nat. Hist., 8, 1936:135), I expressed the opinion that they were intergrades between *Phalaenoptilus nuttallii* of eastern Arizona and *Phalaenoptilus nuttallii hueyi* of the lower Colorado River Valley, although nearer to the former. Mr. L. M. Huey has recently collected an additional series in the same locality. In the course of a recent inspection of certain Sonora birds in the Field Museum of Natural History, I found two similar Poor-wills taken at the Providencia Mines in central Sonora, and a re-examination of five specimens from Oposura [=Moctezuma], also in central Sonora (Museum of Comparative Zoology), shows them to belong in the same category. It is thus apparent that the birds from Bates Well are not intergrades but belong to an undescribed race which I name as

Phalaenoptilus nuttallii adustus new subspecies
Sonora Poor-will

Type.—Adult male, no. 50513 Dickey Collection; Bates Well, Pima County, Arizona, altitude 1500 feet, June 22, 1932; collected by A. J. van Rossem.

Subspecific characters.—Similar to *Phalaenoptilus nuttallii nuttallii* of the western United States in general, but slightly paler and decidedly browner throughout, this color being apparent in the "frosting" of the head and pectoral region as well as in the plumage in general. Similar to *Phalaenoptilus nuttallii hueyi* of the lower Colorado River Valley and, like that race, with "frosting" light grayish brown rather than silvery, but coloration throughout decidedly darker.

Range.—Extreme southern Arizona south through the Lower Sonoran Zone at least to lat. 29° 45' N. in Sonora (El Alamo; Providencia Mines; Moctezuma).

Remarks.—No differences in measurements of note are to be found between the three races here compared.

Poor-wills from extreme south-central Arizona (Upper Sonoran Zone in the Santa Rita, Atasco, and Pajarito mountains) and extreme north-central Sonora (Rancho La Arizona near Saric) are variable in color, some approaching *adustus* very closely, but the great majority do not appear to be different from *nuttallii* from the general range of that race.

I wish to thank Dr. L. B. Bishop, the Museum of Comparative Zoology, the Los Angeles Museum, and the Field Museum of Natural History for the loan of necessary specimens. Comparative material used was as follows: *adustus*, 21 from localities given above; *dickeyi*, Lower California, 5; *nuttallii*, California, 22, Nevada, 2, Arizona, 11, Washington, 1, British Columbia, 1, Montana, 2, Texas, 2, Kansas, 2, Sonora, 9; *hueyi*, California, 15; *californicus*, California, 17.—A. J. VAN ROSSEM, *Dickey Collections, University of California at Los Angeles, June 10, 1941.*

Rock Wren Nesting in a Petrified Log.—In late May of 1941, the nest of a Rock Wren (*Salpinctes obsoletus*) was discovered in a tunnel-like cavity in a petrified log back of the museum at the Petrified Forest National Monument, Arizona. Since these logs are upper Triassic in age, perhaps 160,000,000 years old, the nest site is, in one sense, the oldest to be recorded. The pair of wrens successfully raised three young, which left the nest early in June. The site itself was a cavity of circular outline, three inches in diameter, which extended back into the petrified log some four feet. The logs petrified here are called *Araucarioxylon* and are related to the modern monkey puzzle tree of the southern hemisphere.—LOYD MASON SMITH, *Holbrook, Arizona, June 25, 1941.*

Cliff Swallow Colonies of the Central Sacramento Valley in 1941.—Between April 20 and May 30, 1941, the writer had occasion to traverse approximately 850 miles of roads in the Sacramento Valley, California, between Sacramento and Marysville, an area of about 1600 square miles. Each flock of Cliff Swallows (*Petrochelidon albifrons*) encountered on these travels was investigated and recorded on a spot map together with pertinent data on numbers of individuals, nest sites and nesting activity.

A total of 68 colonies comprising approximately 3200 birds was recorded (fig. 70). Undoubtedly colonies were missed, but since every river and creek bridge in the area was visited, the survey is thought to approach completeness. Colonies ranged in size from a single pair (one instance) to 320 pairs, and averaged 60 pairs. Numbers were determined by direct counts of nests or birds, or, when this was impracticable, by rough estimate. Barn Swallows (*Hirundo erythrogaster*) nested in close

association with the Cliff Swallows in 6 colonies, and English Sparrows (*Passer domesticus*) had appropriated swallow retorts in several instances.

The average spacing of recorded colonies was one to every five miles, but distribution was far from uniform. Colonies were most numerous around irrigated farm lands near the river channels and least numerous in poorly watered grain and pasture lands. Foraging areas were small and colonies often were closely spaced. Two of the largest colonies (near Nicolaus) were scarcely half a mile apart, and three colonies of 75, 30 and 200 pairs, respectively, were located within a distance of two miles along the "river road" east of Woodland.

The main requisites for a nesting site in the area surveyed seem to be: (1) a protected vertical surface, preferably of stone, concrete or stucco, under an overhang, for the attachment of nests; (2) a reasonably open terrain in the immediate vicinity of the nesting site; and (3) a readily available supply of wet mud (and water?) close to the nesting site. All the colonies in the area were on man-made structures: 39 on concrete bridges, 13 on wood bridges, 7 under the eaves of concrete or stucco buildings, 8 under the eaves of wood buildings and 1 under a steel bridge. The 200 nests in this latter colony were situated on the draw of a draw bridge so that they were tilted through 90 degrees at each raising of the bridge, which occurred at least once a day.—JOHN T. EMLEN, JR., *University of California, Davis, June 24, 1941.*

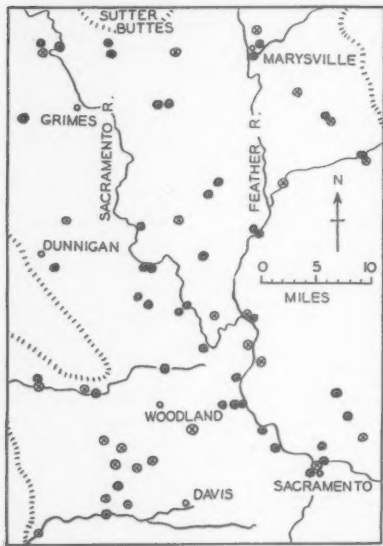


Fig. 70. Location of Cliff Swallow colonies in Sacramento Valley in 1941. Circles enclosing crosses represent colonies of less than 25 pairs; solid dots, larger colonies.

Ancient Murrelet in Northern Idaho.—On December 29, 1929, an adult female Ancient Murrelet (*Synthliboramphus antiquus*) was found dead by Mr. John C. Lindgren of Coeur d'Alene, on Hayden Lake, Kootenay County, Idaho. The bird was given to me and was prepared as a specimen. It was poor in flesh and the stomach and intestines were shrunken and empty, but the plumage was in perfect condition. The specimen, no. 3357 of my collection, is now in the collection of Dr. Louis B. Bishop.—CHAS. FOOTE HEDGES, *Coolin, Idaho, June 20, 1941.*

Robin Nesting at Pacific Grove, California.—On June 24, 1941, the nest of a Robin (*Turdus migratorius*) containing three eggs was found in Pacific Grove, Monterey County, California. The nest was built against the trunk of a Monterey pine, about twenty feet above the ground. Its support was concealed by the mass of nesting material, but presumably it rested on a short dead stub of a branch, as there were many such stubs along the trunk. One adult was singing near by; another was on the nest in an attitude of incubation. So far as I am aware this constitutes the first breeding record for the Monterey Peninsula.—LAIDLAW WILLIAMS, *Carmel, California, July 25, 1941.*

Man-o'-war-bird in Santa Barbara County, California.—Man-o'-war-birds are sufficiently uncommon in California to make it worthwhile to record one more. A bird was seen on July 11, 1941, at a distance of as little as 100 feet, along the beach and a short distance inland, about five miles west of Gaviota, Santa Barbara County, California. It was seen by several observers beside myself, one of whom was familiar with the genus in the tropics. The bird was working westward parallel to the shore. Its light head and breast showed that it was an immature individual, probably of *Fregata magnificens*, since the rufous cast over the head, as described for *F. minor*, was not noted.—RICHARD M. BOND, *Oakland, California, July 23, 1941.*

Black-headed Grosbeak Nesting at Fresno, California.—Although the occurrence and nesting of the Black-headed Grosbeak (*Hedymeles melanocephalus*) has been noted by local observers at Fresno, California, in recent years, it is interesting to point out that Fresno was originally a semi-arid desert area unfavorable to this species. These grosbeaks usually are inhabitants of the more forested regions and wooded stream sides. Undoubtedly introduced cover and the trees in the parks of Fresno have attracted them. These fine areas of trees and moist lawns have also made possible the summer residence of the Western Robin.

The grosbeaks were first recorded by the writer on April 17, 1941, and by May 3 a nest had been constructed and a normal complement of three eggs was present. Approximately thirteen days later, the three purplish young had hatched; seven days after this the entire brood disappeared. This was the result of visits to the nest by the introduced western fox squirrels (*Sciurus niger rufiventer*). These mammals, by reason of overabundance, present a problem for the nesting birds in the municipal Roeding Park area. In 1940, a grosbeak nest situated in the same tree as this year's nest was destroyed in a similar manner.

To illustrate the ecological changes and resultant acquisition of nesting birds in recent years, it is to be noted that Tyler (Pac. Coast Avif. No. 9, 1913:87-88, 108) reported Western Robins in Fresno as winter and early spring migrants, the main band leaving in March, and Black-headed Grosbeaks were seen by him only in the spring as they loitered before passing on to more suitable summer homes. At the present time, both species are raising young in this region.—RICHARD H. BOYER, *Fresno, California, June 16, 1941.*

Inland Record for the White-winged Scoter.—Inasmuch as published records of the occurrence of the White-winged Scoter (*Oidemia deglandi*) on fresh water are comparatively few, it may be worth while to record the presence of an adult female of this species at a small reservoir in Prospect Park, Redlands, California, on November 8, 1937. The bird was remarkably tame, allowing the observer to secure an excellent view at close range with a minimum of effort. Our identification was confirmed by Harold Hill. The scoter freely exhibited its ability as a diver, and was under the water for a considerable part of the time. Approximately ten days after its appearance we were surprised to find that the scoter was absent. We later learned that it was shot by one of our neighbors. The normal habitat of this species, along the ocean beaches, is approximately eighty-five miles from Redlands.—MILTON MOORE and DONALD MOORE, *Redlands, California, June 3, 1941.*

The Thick-billed Kingbird of Northern Sonora.—Several years ago when J. T. Wright was engaged in collecting birds in Sonora, one of his most interesting discoveries was that of a breeding colony of Thick-billed Kingbirds (*Tyrannus crassirostris*) at Rancho La Arizona in the extreme north-central part of the state and only about thirteen miles in an airline from the Arizona boundary. These birds were recorded by the present writer (Trans. San Diego Soc. Nat. Hist., 6, 1931:259) as from Saric, the locality given on Wright's labels. However, when Robert Hannum and I visited the region in May, 1937, we found Wright's collecting to have been done at Rancho La Arizona, several miles closer to the border than Saric and in a higher life zone. This ranch is at an altitude of 3200 feet, just at the juncture of Lower and Upper Sonoran zones, although the latter is dominant. Saric is several hundred feet lower and is strictly Lower Sonoran. On the occasion of our own visit to Rancho La Arizona we succeeded in collecting two pairs of these kingbirds and saw several other individuals.

All of them were in riparian growth, chiefly willows, cottonwoods, walnuts, and giant mesquites, which grow along the small stream, a fork of the Altar River which at its headwaters in Arizona is known as Bear Creek.

This colony of Thick-billed Kingbirds seems to be isolated from its nearest neighbors by 300 miles, for the species reappears again only in extreme southeastern Sonora, where it is not uncommon along streams in the Arid Tropical Zone. Wright found no trace of it at any of the several intervening localities where he worked, nor have Chester Lamb, W. W. Brown, myself, and several other collectors detected it.

A careful inspection of nine northern specimens shows several departures from the race *pompalis* which make a separate name for them desirable. I propose

Tyrannus crassirostris sequestratus new subspecies
Northern Thick-billed Kingbird

Type.—Breeding adult male, no. 28580 Dickey Collection; Rancho La Arizona, Sonora, Mexico, altitude 3200 feet; collected June 11, 1929, by J. T. Wright.

Subspecific characters.—Compared with *Tyrannus crassirostris pompalis* Bangs and Peters of southern Sonora, upper parts darker and grayer; wing coverts with light edgings narrower and nearly obsolete; posterior under parts paler yellow; bill very slightly shorter but decidedly deeper (10 per cent) throughout its length.

Range.—Known only from the type locality.

Remarks.—The describers of *pompalis* were misled, in one respect, by the notorious fading to which many of Frazer's skins are subject. Recently collected specimens of that race are slightly darker and grayer dorsally than *crassirostris*, not paler and grayer as originally supposed. It also has a slightly more highly arched culmen than *crassirostris* and seems to be in every respect a race intermediate between *crassirostris* and *sequestratus*.

I examined Swainson's type of the nominate race when at Cambridge, England, in 1933 and found it to be a typical Bullock skin, flattened, distorted, and almost devoid of stuffing. It is so faded by the passage of over a hundred years as to be worthless for color comparisons. The measurements taken at the time are: wing, 128 mm.; tail, 96; exposed culmen, 27.4. No indications of locality are on the tag other than "Bullock Mexico." It is a female to judge by the degree of primary emargination. Since Swainson originally named *crassirostris* from "the warm districts of Mexico" and later (Phil. Mag., n. s., 1, 1827:368) listed it as inhabiting "Maritime and tablelands," it would appear that the selection, as a restricted type locality, of Acapulco, Guerrero, by Bangs and Peters (Bull. Mus. Comp. Zool., 68, 1928:306) is an excellent one. Indeed it may well be the actual type locality, for there is good, though not conclusive, evidence that Bullock was at one time in Guerrero. I refer to the type of *Xiphorhynchus flavigaster* Swainson which is also a Bullock skin and very definitely of the Guerrero race (see Proc. Biol. Soc. Wash., 52, 1939:15).

It may be well to emphasize that kingbirds with green or olive backs and yellow underparts change color very rapidly after the annual molt. The backs become gray with little color tint in a very few months. The yellow underparts become much paler, sometimes in the present species almost creamy white. Post-mortem change seems to be rather different, in that extremely old skins undergo a general paling of the entire plumage. It goes without saying that reasonably recent skins in comparable plumage must be used in making color distinctions.

Measurements.—There seem to be no differences whatever in the wing and tail lengths of *pompalis* and *sequestratus*. In the following table of bill measurements (extremes and averages), sex has been disregarded, as in this respect I can detect no differences between males and females.

	9 <i>sequestratus</i>	15 <i>pompalis</i>
Exposed culmen	25.3–26.8 mm. (26.1)	25.5–28.0 mm. (27.2)
Depth of bill at nostril	10.5–11.5 (11.1)	9.8–10.5 (10.0)

—A. J. VAN ROSSEM, Dickey Collections, University of California at Los Angeles, July 3, 1941.

Racial Determination of Bewick Wrens in the Western Great Basin Region.—Bewick Wrens are of scattered occurrence north of latitude 38° on the east side of the Cascade-Sierran axis and are common in only a few localities. Southward from southern Mono County, California, and Esmeralda County, Nevada (Linsdale, Pac. Coast Avif. No. 23, 1936:92), the Desert Bewick Wren (*Thryomanes bewickii eremophilus*) is encountered regularly as a breeding bird. The more northern occurrences of the species in California and Nevada in summer have been allocated to the race

Thryomanes bewickii drymoecus, the San Joaquin Bewick Wren: West Walker River, 10½ miles south of Yerington, 4500 feet, Lyon County, Nevada (Linsdale, *loc. cit.*); 4 miles northwest of Red Rock P. O. and 8 miles southwest of Ravendale, Lassen County (Grinnell, Dixon and Linsdale, Univ. Calif. Publ. Zool., 35, 1930:331); Surprise Valley, Modoc County (Mailliard, Proc. Calif. Acad. Sci., ser. 4, 16, 1927:333); Sugar Hill and Cedarville, Modoc County (Grinnell, Pac. Coast Avif. No. 11, 1915:159). Swarth (Proc. Calif. Acad. Sci., ser. 4, 6, 1916:71) and Linsdale have either suggested or implied that these birds might be racially distinct from *drymoecus*. In 1932, Oberholser (Sci. Publ. Cleveland Mus. Nat. Hist., 4:8) named the Bewick Wren from the Warner Valley of Oregon, which valley is adjacent to the Modoc region of California. The characters given in comparison to *drymoecus* are, as regards color, essentially those mentioned by Swarth. In essence, the birds of the Modoc-Warner region are less rufescent above and hence are duller or grayer. They are strikingly darker than *eremophilus*. Review of the material from northeastern California convinces me of the propriety of recognizing a race from that section under Oberholser's name *atrestus*.

This conclusion has been supported by study of four additional skins from western Nevada collected by Mr. J. R. Alcorn. Three of these birds were taken in the vicinity of Fallon, Churchill County, March 3, June 3 (juvenile), and June 22; one was taken March 24, 2 miles southwest of Yerington, Lyon County. Also, a winter-taken individual of this race from the Truckee River canyon, thirty miles east of Reno, submitted for identification by Mr. James C. Savage, has been examined.

In Oregon, Gabrielson and Jewett (Birds of Oregon, 1940:455) indicate the occurrence of Bewick Wrens westward from the Warner Valley to the Klamath Basin, the upper Rogue River valley and the Siskiyou Mountains, and Oberholser includes all wrens of this species west to Gold Hill and Ashland, Jackson County, Oregon, in the race *atrestus*, although explaining that birds from Klamath Falls westward are not typical. Wrens from the Rogue River valley in the Museum of Vertebrate Zoology seem to me to belong with *drymoecus* and to suggest intergradation between this race and *calophonus* to the north. *Atrestus* thus is viewed by me as a Great Basin race, extending as far as the Klamath Lake basin (no. 81397 Mus. Vert. Zool.), and from southern Lake County, Oregon, south through Modoc and eastern Lassen counties of California, and through western Nevada to Lyon County. *Drymoecus* therefore does not occur in western Nevada and northeastern California.

Heretofore Bewick Wrens have not been reported as summer residents north of Klamath County on the east side of the Cascade Mountains in Oregon. It was with much surprise, therefore, that I found a singing male, this past summer, at a point 7 miles northwest of Sisters, 3300 feet, in Deschutes County. The bird (no. 81699 Mus. Vert. Zool.) was taken on June 15 in a tangle of brush at the edge of a meadow. Previous to collecting it was watched for several minutes as it gave every evidence of being established on a breeding territory. The testes measured 8 mm. in length. Somewhat unexpectedly this wren proved not to be *atrestus*, but a typical *calophonus*, matching in detail members of this race from the Columbia River west of Portland. Here then was an outpost, across the mountains, of the dark, ruddy race typical of the humid coast belt.—ALDEN H. MILLER, *Museum of Vertebrate Zoology, Berkeley, California, August 11, 1941.*

NOTES AND NEWS

Latest advices from Mr. A. C. Bent are to the effect that the sixteenth volume of his "Life Histories" series will include the Mimidae in addition to the families previously announced (Condor, 43, 1941:203) for that volume. Contributions of notes and photographs would be appreciated by Mr. Bent.—A. H. M.

The officers charged with the arrangements for the Tenth International Ornithological Congress scheduled to have been held in the United States in 1942 announce that the proposed meeting has been indefinitely postponed.

The Fifty-ninth Stated Meeting of the American Ornithologists' Union held in Denver, Colorado, September 1 to 6, 1941, enjoyed an excellent attendance from the East, the Middle West, and the Pacific Coast. The notable success of this meeting, the first to be held in Denver, resulted in large measure from the good efforts of the local committee, serving under the chairmanship of Alfred M. Bailey. The current officers of the Union were re-elected. New councilors, elected to replace those whose terms expire, are Frederick C. Lincoln, Hoyes Lloyd, and George M. Sutton. At the sessions of the council representatives of the Cooper Ornithological Club and the Wilson Ornithological Club participated for the first time, James Moffitt and George M. Sutton serving in this capacity. New fellows elected were Alfred M. Bailey, Lawrence E. Hicks, and James A. Munro; new members, John W. Aldrich, William H. Behle, Ian McTaggart Cowan, David E. Davis, Philip A. DuMont, John T. Emlen, Jr., Frederick H. Hamerstrom, Jr., Hamilton M. Laing, Robert T. Orr, and Edward S. Thomas.—A. H. M.

Material for a biography of Louis Agassiz Fuertes, naturalist and bird artist, is being collected by his daughter, Mrs. Mary Fuertes Boynton, R. D. 3, Trumansburg, N. Y. She is eager to have letters written by Louis Fuertes, as well as anecdotes and personal recollections. Letters sent to her will be copied and returned promptly.

MINUTES OF COOPER CLUB MEETINGS

NORTHERN DIVISION

JUNE.—The regular monthly meeting of the Northern Division of the Cooper Ornithological Club was held on Thursday, June 26, 1941, with Mr. W. I. Follett presiding and about 65 members and guests present. Minutes of the Northern Division for May were read and approved. Mrs. Ernestine Arthur, 3200 Shattuck Avenue, Berkeley, California, was proposed for membership by Joseph Dixon.

Milton Seibert reported the nesting of a Hermit Thrush in Redwood Canyon, Oakland, a rare occurrence for this region. Young were seen

on June 1. An Audubon Warbler's nest with young was seen near Sequoia Park on the same day. B. C. Cain described the nest of an Arizona Hooded Oriole, made entirely of palm fiber, in a split frond of a fan palm, at Dimond Park; the young left the nest June 25. Frank Watson had observed many Heermann Gulls, many of them adults, at Half Moon Bay on June 22.

Mrs. T. Eric Reynolds presented a delightful color film, "Just Bush-tits," depicting the construction of a nest in an oak near the front door of the Reynolds' home.

Adjourned.—FRANCES CARTER, *Recording Secretary*.

SOUTHERN DIVISION

MAY.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at Lower Shake Camp, near Elizabeth Lake, on Sunday, May 25, 1941, with President Hildegard Howard in the chair and about forty members and guests present. The minutes of the Southern Division for March were approved as read. The minutes of the Northern Division were read by title only. The application for membership of Mr. Charles Beach of Vail, Arizona, proposed by I. Stokely Ligon, was read.

Mr. W. W. Bennett presented a resolution opposing the proposed plan of the Board of Directors of the Los Angeles Museum in curtailing the Department of Science and History and diverting the funds to other channels, and moved that it be adopted. The motion was seconded by Dr. W. A. Hilton and unanimously carried.

George Willett reported a new publication on the American Coot.

Adjourned.—IRWIN D. NOKES, *Secretary*.

JUNE.—The regular monthly meeting of the Southern Division of the Cooper Ornithological Club was held at the Los Angeles Museum on Tuesday, June 24, 1941, with Vice-president Sherwin F. Wood in the chair and about forty members and guests present.

The minutes of the May meeting for the Southern Division were approved as read. The application for membership of Richard H. Boyer, Route 1, Box 30, Fresno, California, proposed by William T. Shaw, was read.

A report of the committee on protests regarding the proposed reorganization of the Los Angeles Museum of History, Science and Art was read by Dr. A. W. Bell, and filed with the Secretary.

Vice-president Wood introduced Mr. Wendell Taber of Cambridge, Massachusetts. He gave a very exhaustive and entertaining lecture on the birds of New England, after which the meeting was opened for general discussion.

Adjourned.—IRWIN D. NOKES, *Secretary*.

For Sale, Exchange and Want Column.—Each Cooper Club member is entitled to one advertising notice in any issue of *The Condor* free. Notices of over ten lines will be charged for at the rate of 15 cents per line. For this department, address JOHN MCB. ROBERTSON, Buena Park, California.

BIRD REFERENCE work of any kind done at the U. S. National Museum for distant ornithologists. I have full access to the collections and library. Terms: 50 cents per hour. Address: Dr. E. M. HASBROUCK, U. S. National Museum, Washington, D. C.

WANTED—Wilson Bulletin, No. 65.—W. LEE CHAMBERS, 2068 Escarpa Drive, Eagle Rock, California.

FOR SALE—Birds of Pennsylvania, Warren, 1888; *The Young Oologist*, vol. 1, bound; Birds of Kansas, N. S. Goss, 1886; Hawks and Owls of the U. S., A. K. Fisher, 1888; *Nidologist*, vols. 1, 2, 3, and eight numbers of 4. What am I offered?—P. C. CHADWICK, 426 W. Olive Ave., Redlands, Calif.

FOR EXCHANGE—Skins and sets of many rare northern birds, as A. O. U. nos. 130, 135, 136, 138, 148, 149.1, 152, 154, 155, Northern Eider, Iceland Mallard, Merganser, Pintail, Black Scoter, etc., for Bent's Life Histories of North American Birds, Nos. 107, 113, 121, 126, 130, 135, 142, 146, 162 and 167, single copies or all.—WILLIAM F. PALSSON, Halldorsstadir, Laxardal, via Husavik, Iceland.

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WANTED—Copies of Piper's *Flora of Washington*, and Dawson and Bowles' *Birds of Washington*, in the students one-volume edition only.—J. L. SLOANAKER, 1117 Maxwell Ave., Spokane, Wash.

WANTED—Exchange lists of bird and natural history publications. Before disposing of your magazines and books, send me your list and I will send mine in return. There are many publications that I need, especially early bird magazines.—F. J. PIERCE, Winthrop, Iowa.

FOR SALE—Several unbound volumes of *The Condor*, 1915 to 1938, nearly all of them complete.—GEORGE MIKESCH SUTTON, Cornell University, Ithaca, New York.

FOR SALE—Almost as new, copies of the following: G. S. Miller, *List of North American Recent Mammals*, 1924 (U. S. N. M. Bull. 128), \$4.00; *List of North American Land Mammals in the U. S.* National Museum, 1912 (U. S. N. M. Bull. 79), \$1.00; E. A. Mearns, *Mammals of the Mexican Boundary of the U. S.*, Part I: Didelphidae to Muridae, 2 maps, 11 pls., 126 figs., 1907 (U. S. N. M. Bull. 56), \$0.75.—W. LEE CHAMBERS, Eagle Rock, Calif.

TRAPS FOR SALE BY THE WESTERN BIRD BANDING ASSOCIATION

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WBBA Warbler Trap, ⁵ 8½"x15½"x9½"	3.00	3.25
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WALTER I. ALLEN, 2057 Pepper Drive, Altadena, California.

